AVIATION WEEK

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December 10, 1956 50 cents

Molybdenum Offers Higher Strengths For Higher Speeds

Sikorsky HR2S-1W

AVIATION CALENDAR

Dec 17—Annual Wright Day Dinner Sheraton Park Hotel Washington, D C

Dec 28-31—Third King Orange International Model Plane Contest U S Marine Corps Air Station, Miami, Fla

Jan 21-22, 1957—Symposium on Solar Furnace Design and Operation Hotel Westward Ho Phoenix Ariz

Jan 27-28—American Society for Metals Albuquerque and Los Alamos Chapters Heat Tolerant Metals for Aerodynamic Applications Albuquerque N M

Jan 28-31—8th Plant Maintenance & Engineering Conference Public Auditorium Cleveland Ohio

Jan 31—Sixth Annual Instrument Short Course, Los Angeles Harbor Junior College Wilmington, Calif Additional course will be held Feb 1

Feb. 7—Operations Research Symposium, University Museum Lecture Hall University of Pennsylvania Philadelphia Pa

Feb. 14-15—1957 Transistor and Solid State Circuits Conference

Feb 7—Annual Mid-Winter Symposium of the New York Section, Instrument Society of America, Garden City Hotel Long Island, N Y

Mar 7-9—National Conference on Aviation Education, Hotel Mayflower Washington, D C

Mar 11-15—1957 Atomic Exposition including Nuclear Engineering & Science Congress 5th Atomic Energy in Industry Conference and 5th Hot Laboratories & Equipment Conference Convention Hall, Philadelphia Pa

Mar 18-21—Pacific Coast Plastics Exposition, in conjunction with The Society for Plastics Industry National Conference, Shrine Exposition Hall Los Angeles

Mar 19, 20, 21—151st National Meeting of the American Meteorological Society, University of Chicago

Mar 25-27—Silver Anniversary Technical Meeting and Convention American Society of Tool Engineers Shamrock Hilton Hotel Houston, Tex

Mar 25-29—Western Metal Congress and Exposition Ambassador Hotel and Pan-Pacific Auditorium Los Angeles

AVIATION WEEK • DECEMBER 10, 1956
Vol 65, No 24

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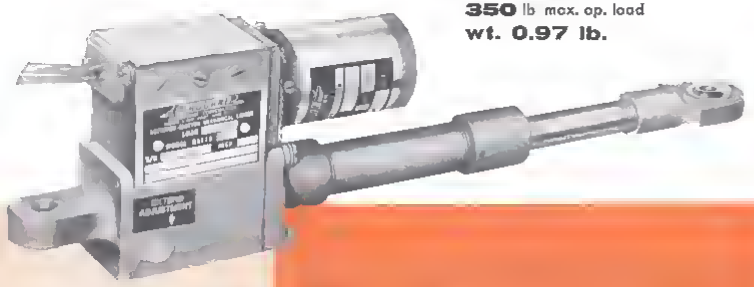
THE INFORMATION ON THIS PAGE IS TYPICAL OF THE DATA YOU WILL FIND IN THE NEW AIRBORNE CATALOG

LINEAR ACTUATOR

R-5170

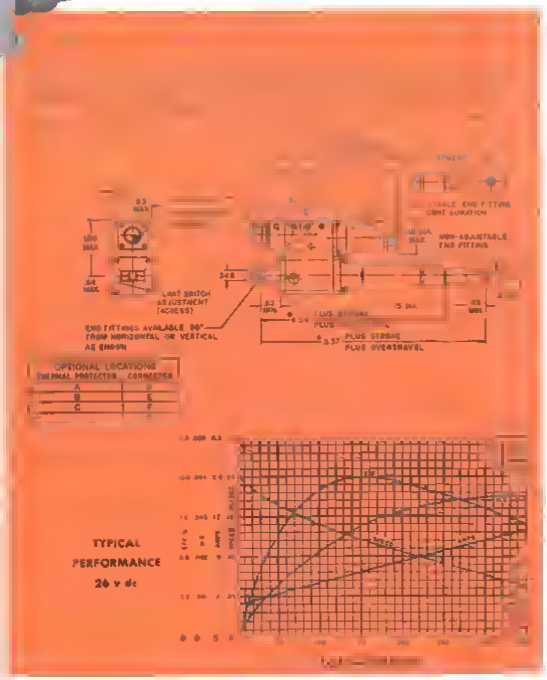
350 lb max. op. load

wt. 0.97 lb.



GENERAL ENGINEERING DATA:

1. 26 volt dc split field, series wound reversible, intermittent duty motor with magnetic brake. Available with thermal overload protector
2. Unit includes limit switches externally adjustable through entire length of stroke, positive overtravel stops, overload clutch, and anti-rotation device
3. Maximum operating load—350 lb. Ultimate static load—1000 lb for 12 inches maximum extended length
4. Weight 0.97 lb. Plus 0.03 lb. x stroke in inches Plus 0.04 lb. for thermal overload protector.
5. Maximum dimensional tolerance ± .03 in unless otherwise specified.
6. Dimensions given are minimum lengths for zero stroke To determine minimum length for required stroke, add stroke plus stroke overtravel plus total end fitting adjustment.



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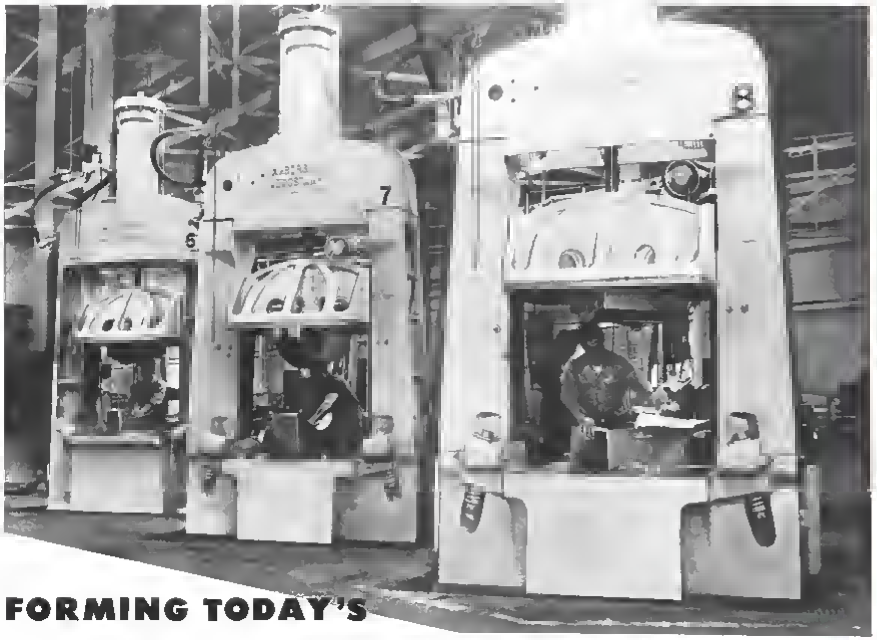

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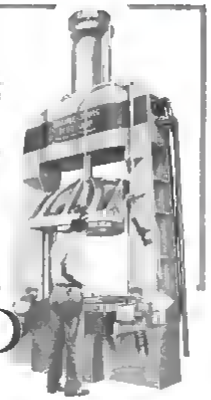
4 *Skillful operators can develop and form many shapes difficult to form on any other type of press*
5 *Controlled blow is well suited to forming large integral parts*
6 *Low tooling cost and rapidity of die fabrication*



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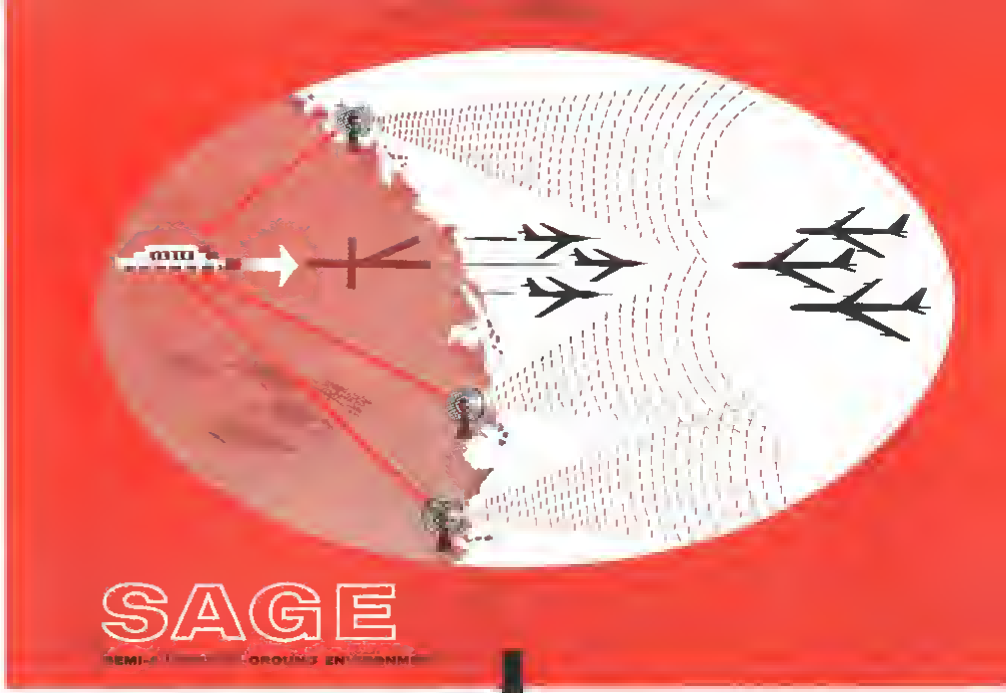

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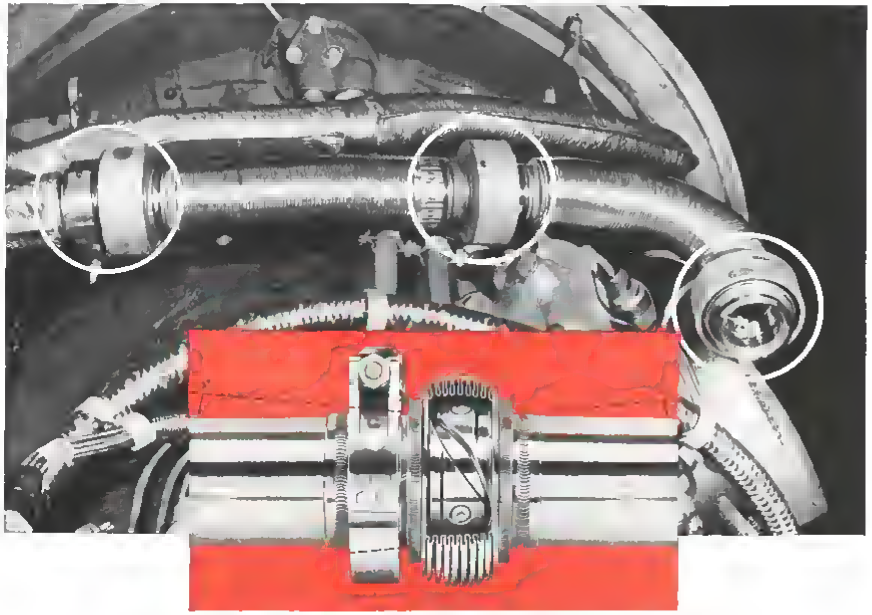

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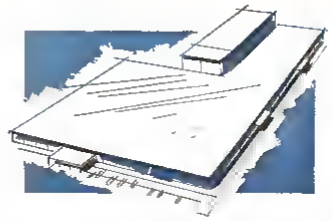

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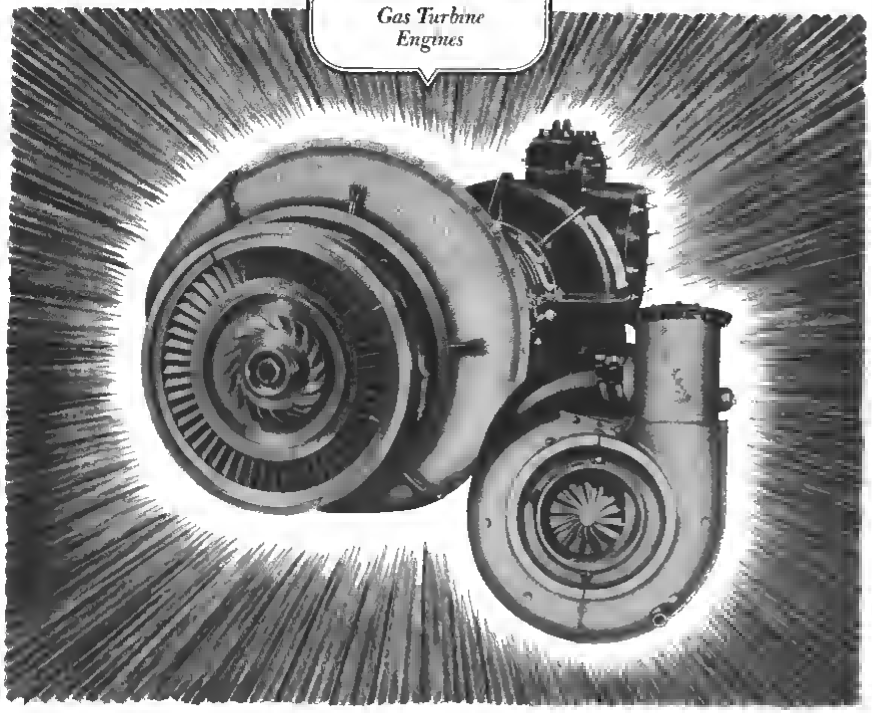

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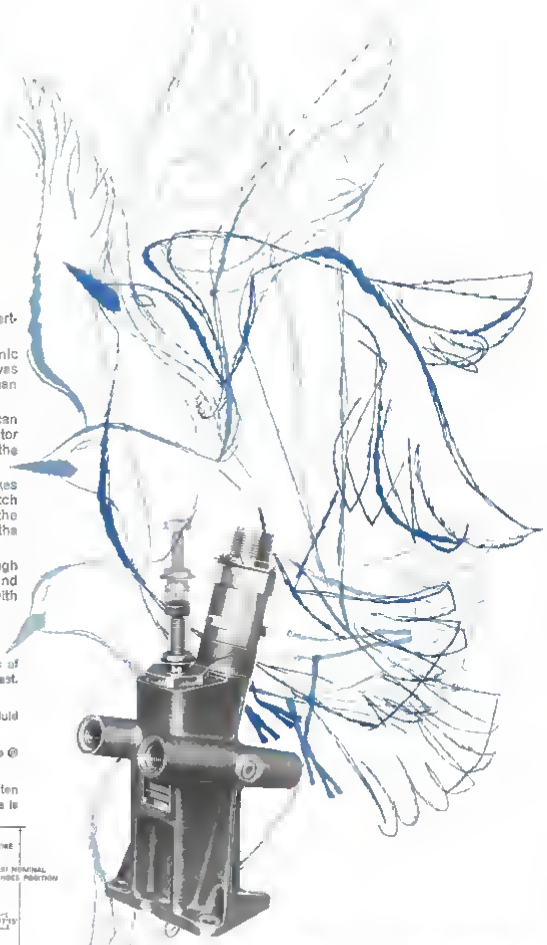

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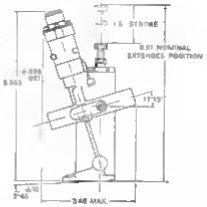

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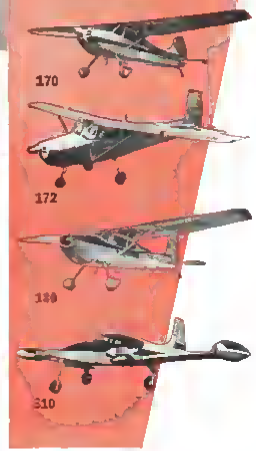

Mounting arrangement at each point of Lord Dynafocal Suspension on Cessna 182.

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COVER Bulbousness of chin of Sikorsky HR2S-1W radar helicopter is accentuated in view from below. Modification of the twin-engine, five-bladed rotor helicopter is for use as early warning radar platform (AW Nov. 12, p. 28). The AN/APS-20E surveillance radar is produced by General Electric's Light Military Electronic Equipment Dept. Other pictures page 30

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EDITORIAL

Don't Scare the Passengers

The airlines have a continuous public relations problem of enormous magnitude. They must deal not only with the approximately 43 million passengers who will use their services this year, but also they must bend their efforts to attracting the additional millions that are required for the continued growth of air transport, particularly in the jet age ahead.

In the old prewar era of the DC-3, the airlines' passenger service was more than adequate, and the faithful few customers loved it despite the uncertain operations, unpressurized cabins and slow speeds. In the postwar era, when the airlines offered major increases in speed and efficiency of flight operations, the rush of new customers simply swamped passenger service facilities and techniques.

Somehow, the volume of passengers has seemed to stay ahead of the airlines' best efforts to catch up with their passenger service capability. During the past year, we think U.S. airlines have been devoting more effort than ever before toward giving their passengers a better break once they have decided to fly. We notice spots of improvement here and there, such as the speed up in baggage handling at Los Angeles Airport, eliminating a lot of needless ticketing red tape for air travel card holders and even a kind of courteous tone of voice from reservations clerks of airlines that have been notorious for their neglect of the passenger's problems.

We also see signs that some airlines are trying to keep the passenger better informed on delays in flight arrivals and departures. Pilots have helped a lot on this score in recent years. Their microphone chatter from the cockpit gives the passengers an idea of how the flight is being operated, what there is to see en route and what's happening in the terminal area.

'Mechanical Delay' Hazard

The long sweat of an instrument approach is never half so long when the pilot gives his cabin load of passengers a commentary on their progress, or lack of it, through the stacks. In reverse, nothing gets the passengers to sweating more than a cheery announcement by the stewardess that "we will be landing in five minutes" followed by a half hour of churning through the soup accompanied by turbulence and the moaning and groaning of hydraulic relief valves and the flap and gear mechanisms.

There is one area of passenger information service that is generally being handled pretty poorly, with the result that many passengers are unduly frightened about the air travel on which they are about to embark. This is the almost universal custom of explaining delays due to mechanical causes in the curt, imagination stimulating phrase "mechanical delay." I have watched many a knot of passengers awaiting departure buzz with apprehensive conversation when that phrase is chalked on the bulletin board or relayed over the public address system. Nine times out of 10, the actual cause of a mechanical delay is minor, but the unsophisticated passenger usually assumes the worst and begins to fret, often for the duration of his journey, until a safe landing has been made.

We would like to cite a few examples of how a little more detailed explanation might have eased a lot of passengers' minds and made them more appreciative of the airlines' regard for them. This summer we were waiting to board a transatlantic flight of a U.S. flag carrier at Idlewild. The public address system announced a 45-minute delay due to mechanical trouble. Well, this is not a very heartening thought to 60 passengers about to entrust themselves to an airline for a long over-water hop. We investigated and found the problem was nothing more serious than a sticky brake drum on one of the main landing gear wheels that was being replaced.

Unnecessary Apprehension

In a similar case, with a foreign flag carrier about to originate one of its deluxe transatlantic services from a European terminal, an hour's "mechanical delay" was announced. It was only a minor mechanical problem, but, to the passengers about to cross the Atlantic in that aircraft, it created a lot of unnecessary apprehension that a prompt and detailed explanation would have dissipated.

On a transpacific flight to Honolulu, we recall a crew of mechanics racing around the forward cabin of the aircraft for an hour trying to fix nothing more dangerous than a clogged water faucet in a lavatory. This was done amid much standard type mechanic's cursing while all the passengers were aboard. How much simpler to have kept the passengers in the terminal while these antics were going on aboard the aircraft.

We recall several incidents at en route stops in the domestic system where mechanics swarmed aboard, while through passengers were still in the aircraft, and treated them to a stream of profanity and frantic activity that made it apparent to the uninitiated that it was doubtful if that aircraft would ever fly again. How much simpler if the passengers were off-loaded during this particular type of drill?

To illustrate how proper explanation of mechanical delays is appreciated by passengers, we cite one rainy, blustery night at LaGuardia when instrument approaches were necessary all along the Atlantic coast. With a full load of passengers aboard, the door of this transport suddenly opened to admit a quartet of mechanics dripping rain from their oilskins. They wrestled in the cockpit for over 30 minutes before the aircraft was ready to go. But hardly had they disappeared forward into the cockpit when the stewardess announced to the passengers, "Don't worry folks, it's just the co-pilot's seat that is stuck, and we'll have to get it back in adjustment before we can leave."

The passengers relaxed back into reading their newspapers and magazines and never gave it another thought. We checked to see if that was really the trouble and it was.

Most of the passenger annoyances with airline service involve small but irritating areas that many airline employees regard as too minor for serious attention. But anything that contributes to making the passenger happy with air transport is a major contribution to the airline's prosperous growth. Don't scare the passengers unnecessarily, they are the best friends the airlines have.

—Robert Hotz

WHO'S WHERE

In the Front Office

Philip E. Golde and **A. G. Handschumacher**, senior vice presidents, Lear, Inc., Santa Monica, Calif. Mr. Golde is secretary and general counsel of the company, and Mr. Handschumacher is director-sales and overseas operations.

Thomas W. Johnson, vice president, New York Air Brake Co., New York, N. Y.

Robert E. Heter, vice president-original equipment sales, and **Scott M. Kennedy**, vice president-Parts Division, Aluminum Industries, Inc., Cincinnati, Ohio.

Henry M. Hasse, vice president-engineering and research, Borg Warner Corp., Chicago, Ill.

Glenn A. Walters, vice president-director of research, Dalmo Victor Co., division of Textron, Inc., San Carlos, Calif.

Edward H. Perkins, Jr., vice president, Brooks & Perkins, Inc., Detroit, Mich.

John Schmidt, vice president-sales, New Plastic Corp., Los Angeles, Calif.

Allen W. Rockwell, vice president, Waterbury Division, American Brass Co., Waterbury, Conn. Mr. Rockwell succeeds **Ralph T. Benedict**, retired.

Edmund O. Schroeder, vice president-maintenance, Seaboard & Western Airlines.

David D. Stone, vice president-sales and customer relations, Wyle Laboratories, El Segundo, Calif.

Charles F. Willis, Jr. of W. R. Grace & Co., and **James L. Spencer**, management consultant, directors, Aero Supply Manufacturing Co., Inc., Corry, Pa.

Walter Sternberg, vice president-planning, National Airlines, Inc.

Robert A. Goebel, assistant vice president-purchasing and stores, American Airlines.

Honors and Elections

William T. Schwendler, senior vice president and one of the founders of Grumman Aircraft Engineering Corp., has been elected to New York University's Board of Trustees.

Flight Safety Foundation, Inc., honored four persons at FSF's eighth annual international air safety seminar. Recipients of the 1956 awards, presented on behalf of Aviation Week, were **Melvin Gough**, head of flight research for the National Advisory Committee for Aeronautics, Langley Field, Va.; **Arthur E. Jenks**, chief of flight inspection for the Civil Aeronautics Administration; **William Littlewood**, vice president of equipment research for American Airlines, Inc., and **Dr. Edward P. Warner**, president of the Council, International Civil Aviation Organization.

Dr. Louis N. Ridenour, director of research for the Lockheed Missile Systems Division, has been inducted into the national engineering honor society Tau Beta Pi at the University of California.

Maj. Gen. John M. Weikert (USAF, ret.) has been elected chairman of the Aircraft Industries Association's export committee for 1957. Gen. Weikert is the Washington, D. C. representative of United Aircraft Export Corp.

(Continued on page 129)

INDUSTRY OBSERVER

► Second round in the Vanguard satellite test program is scheduled to begin next month. It will be the 14th, and last, Martin-built Viking rocket and will be modified by replacing the nose cone with the proposed Vanguard third stage. Third stage is being developed by both Allegany Ballistic Laboratory and the Grand Central Rocket Co.

► North American F-107 has surpassed Mach 2 in straight and level flight at altitude during tests at USAF Flight Test Center, Edwards AFB, Calif. Among the pilots who have flown the F-107 at maximum performance without encountering pitch-up or other major stability and control problems is Maj. Gen. Albert F. Boyd, deputy commander of the Air Research and Development Command for Weapon Systems. USAF previously has announced a cut in a planned F-107 production program back to three experimental aircraft.

► Army's Hawk anti-aircraft missile has delta wings of very short span and very large root chord, with a leading edge sweep angle approaching 80 degrees.

► North American X-15, extreme altitude, rocket-powered research aircraft will use a liquid-propellant powerplant manufactured by Reaction Motors Inc.

► Defense Secretary Wilson's 20,000-lb. limit on Army helicopters (AW Dec. 3, p. 30) has a single compensating virtue in the eyes of Army aviation leaders—it may encourage manufacturers to design lighter rotary-wing aircraft, spur interest in flying cranes.

► Dassault's Mirage 3, a lightweight interceptor prototype, has begun its flight-test program. The delta-wing jet is powered by a Snecma/Atar G engine with afterburner and has reported speed of approximately Mach 1.5 at operational altitude.

► Severe vibration has been encountered in nose homing device of Navy's Terrier surface-to-air missile manufactured by Convair Division of General Dynamics Corp. Steps are currently being taken to isolate and damp out the vibration.

► Major modifications have delayed delivery of the DeLackner Aerocycle for test by Continental Army Command's Board 6. The Ft. Rucker, Ala., unit of CONARC will study the aircraft's mechanical reliability, logistical support requirements and flight characteristics.

► Douglas RB-66 production will be phased out late next year unless USAF places a follow-on order. Under present contract, last units probably will come off Douglas' Long Beach, Calif., and Tulsa production lines in September or October.

► Aircraft Marine Engineering Co., Los Angeles, is completing a full-scale mockup of a light utility jet aircraft. Target price of production models is approximately $150,000.

► Argentine government reportedly has acquired manufacturing and sales rights for all of South America for Morane-Saulnier's four-place Paris executive jet aircraft. The twin-jet Paris will be built by Fabrica Militar de Aviones. Manufacturing and sales rights in U. S. are held by Beech Aircraft.

► Army tests of the Bell HSL tandem helicopter resulted in a better report than that given by the Navy, which subsequently cut back production orders. One HSL is being modified for the Army for pickup tests with mockups of missile designed and prepared by Redstone Arsenal. The load exceeds the capability of the Vertol H-21C and Sikorsky H-34. The HSL will be ready for these Army tests in April. Army also says HSL is best towing vehicle it has tested.

Washington Roundup

Flogoir to MATS?

Comments of the three services and other interested government agencies on a "single manager" plan for turning some 200 two- and four-engine Navy Fleet Logistic Air Wing transports over to USAF's Military Air Transport Service (MATS) are being studied by the office of Assistant Secretary of Defense for Supply and Logistics, Thomas P. Pike. The services and agencies were asked to give their opinions on a proposed Defense Department directive, which also would transfer to MATS all air photographic and charting, air rescue, airways and air communications and air weather services, as well as the Air Force's "special air missions" unit, which transports VIPs. All the opinions will be reviewed and considered by Pike's office before any proposed directive goes to Defense Secretary Charles E. Wilson for signing, which means the move, if it comes, probably is still several weeks away.

Army Eyes Weight Limit

Proposed Army aircraft which Defense Secretary Charles E. Wilson indicated he might exempt from the 5,000-lb. fixed-wing weight limit when he issued his memorandum of clarification on service roles and missions (AW Dec. 3, p. 30) is a short-takeoff observation plane being developed jointly by the Army and Marine Corps.

Its weight is approximately 9,000 lb.—well over the limit which was set in 1952 and which Wilson refused to change. Since the memo was issued, the Army has urged that it be allowed to continue development. Official word is that the Defense Department is giving the recommendation "further study," but Pentagon sources feel this amounts to all the approval Army needs to produce some hardware.

They also believe Wilson will approve production, since no other 300-knot aircraft answering Army-Marine needs exists.

Plans for Future

Secretary Wilson's memorandum also probably means that Army Aviation will do less public talking about its ambitions and plans. At present, the Army is most vitally interested in helicopter navigation systems that would permit mass movement at an altitude of only one foot wherever possible. The helicopters would be armed with machine guns and rocket weapons, and work is contemplated on improving rotary-wing aircraft as a platform for these infantry tools. More remote, but still engaging Army attention, is the nuclear-powered seaplane as a key logistic system to supply small, mobile nuclear-age armies fighting in distant countries. Of all the services the Army probably is most dependent upon industry interest in its programs and needs.

Reciprocity

The State Department will resume bilateral negotiations with The Netherlands on March 18, but the prospects for success appear to be little better than they were when discussions became stalemated and were broken off last summer. KLM Royal Dutch Airlines is still pressing hard for authority to serve Houston and Los Angeles in addition to their present rights at New York and Miami. The U.S. would like to sign a bilateral air transport pact with The Netherlands, one of the few nations with which we don't have one, but not at the price of granting KLM rights to Los Angeles and Houston.

U.S. carriers are concentrating on the Fifth Freedom factor in international air travel as a key point in negotiations over trading traffic rights between U.S. and foreign airlines. KLM depends heavily upon Fifth Freedom traffic, rather than on Dutch-originated traffic, and is in favor of a free trade approach to air route exchanges. The American carriers have argued, successfully thus far, that the Dutch don't have enough traffic to trade in return for the new U.S. routes they want and that negotiations should be based strictly on reciprocity.

Tax Repeal Dim

The transportation industry will continue its campaign for repeal of the transportation tax in the coming congressional session, but the prospects for success are dim.

Tax experts admit that the transportation tax has first priority for repeal when a cut is approved. The Treasury Department however opposes any tax cut at present. Industry in its efforts for repeal, points out that abolishment of the transportation tax would be a direct benefit to the public since common carrier rates are regulated and could not be raised as were movie admissions when that admission tax was lifted.

Helicopter operators are making a separate bid to get out from under the transportation tax. They want an exemption from the tax similar to that granted air taxi operators. The helicopter airlines argue that the 10% cut in fares that would result from tax relief would help them stimulate traffic and cut subsidy needs. The carriers also maintain that the tax is discriminatory because air taxi and helicopter operators are competitive, and the exemption favors the air taxi lines.

Tipton Re-Elected to ATA

The Air Transport Assn. board of directors last week re-elected Stuart Tipton to his second term as president of the organization and voted for an expansion of air mail and cargo activities. Advertising budget for cargo, mail and the military traffic programs was increased to more than $360,000 annually, a new ATA high.

The directors also named Seaboard and Western Airlines to an associate membership. All cargo carriers previously made associate members include American Air Export and Import Co., Flying Tiger Line and Slick Airways. In other actions, the board approved a six-month ATA budget without any material changes and authorized increased funds to cover air traffic control studies.

Hungarian Airlift

Air Force and Navy will ferry 16,500 Hungarian refugees into the U.S. before the end of the year in the largest peacetime air and sealift in history. The original plan, announced earlier last week, called for the Air Force to airlift all the refugees in groups of 1,000 a day with 125 MATS C-118s and C-121s. Revised plan calls for airlifting 9,500 over a period of about three weeks, sealifting 7,000, probably in three sailings from Bremerhaven.

—Washington staff

Army Streamlines Aircraft Test Methods

Two new agencies established to help accelerate service tests and develop logistical data.

By Claude Witze

Ft Rucker, Ala.—U. S. Army this month is establishing two new agencies at its Aviation Center here to accelerate service testing of new aircraft and to develop sound logistic data for their support in the field.

The new units, responsible to the Signal and Transportation Corps, are:

- **Signal Aircraft Test and Support Activity**, with cognizance over communications and electronic equipment.
- **Transportation Aircraft Test and Support Activity**, responsible for the aircraft. This unit, headed by Lt. Col. Charles E. Hollis, reports directly to Brig. Gen. William B. Bunker, head of the Transportation Corps Supply Office in St. Louis, Mo.

Significance of the new organizations to the aircraft and avionic industries lies in the fact that the Army expects to slash by more than two-thirds the time required to service test new equipment. The immediate goal is to roll up at least 1,000 flight hours in the first six months. This is a program that, in the past, has required from two-and-a-half to three years.

First piece of equipment to go through the new procedure will be the Sikorsky H-37A twin-engine helicopter. First two aircraft were delivered last week, and the program is scheduled to be fully under way by the first of the year.

Dual Tasks

Each of the new support activities has a dual job:

- To provide field maintenance and supply for Continental Army Command's Board 6, the Army unit at Ft. Rucker which is charged with monitoring the development service test and product improvement work on all new aircraft and support equipment.
- To carry out logistical evaluation of new equipment.

In view of current Army emphasis on the problem of maintaining its aircraft in far-flung theaters, the second mission may be the most important. In early October Gen. Bunker held an industry symposium at St. Louis where this problem was fully aired and new approaches studied (AW Oct. 8, p. 28).

It was revealed in St. Louis that the Army has a poor set of statistical data to guide its purchases of spares and, more important in time of war, to guide its shipment of spares and tools to maintenance echelons in the field.

Col. Hollis disclosed to AVIATION WEEK that one of the key techniques he will use in this effort is to provide spares and overhauled components through a closed circuit supply line. An open contract will permit purchase of spares direct from the manufacturer as needed.

Even more significant if there is a failure in a major component such as an engine, transmission or rotor head, it will be returned to the manufacturer for repair. The job will be done as quickly as possible, and the same unit put back in the aircraft for continued accelerated testing.

Ultimate Aim

The same procedure will hold for communications and electronic equipment monitored by the Signal Corps unit. It will. Army officers believe, result in greater reliability as the manufacturer gets more information and gets it faster, permitting a speedup in corrective action.

Col. Hollis says the entire concept of his new job goes back to an industry meeting held by Gen. Bunker in 1953. At that time, Gen. Bunker demanded helicopters and components that could go 1,000 hours between major overhaul. The industry's reply was that Army test programs themselves hampered such development.

Ultimately, the Army's aim in this program is to dig back into industry as far as the design engineer, making him more conscious of the maintenance problem. Corrective steps also are possible at the design stage that will make it easier to draw up maintenance allocation charts with same degree of accuracy.

The Army frankly admits that it has an incomplete statistics on the hardware, manpower, training and tools it needs at each level in the maintenance picture. On top of this is the necessity for building a support activity capable of moving in the field with highly mobile small tactical units. In short, the effort is to make Army Aviation conform to the new nuclear-age type of organization typified by such recent battlefield concepts as that practiced by the reorganized 101st Airborne Division (AW Oct. 8, p. 79).

Col. Robert R. Williams, president of CONARC Board 6, points out that the setup permits the new Transportation and Signal Corps units to obtain experience from four aircraft while actually flying only two. This is because they have been given responsibility for maintenance of the two aircraft being service tested by Board 6, along with their own accelerated 1,000-hour runs. Thus, the final provisioning figures will be based upon a test circle with four aircraft.

Col. Williams also stresses the fact that Army will use no test of separate items. Only a complete package will be subjected to service and logistic evaluation. This will provide increasingly realistic information, particularly in the field of avionic equipment.

Industry's Role

It is important to industry to have close contact with the program. Service representatives will be on hand during the work, sending information on failures back to the factory, along with orders for replacement parts. Simultaneous tests by the Army technical services and the user in the presence of the manufacturer should give good coordination of results and speed modifications where necessary.

Col. Williams is convinced that faster discovery of deficiencies will cut down on retrofit and modification costs. He has pointed out that service tests of the Vertol H-21 and Sikorsky H-34 helicopters were completed less than six months ago. If production had been held up until they were finished and all changes incorporated in the line, it would be 1959 before the aircraft were operational.

The unit at Ft. Rucker headed by Col. Hollis will consist of 28 officers, 53 enlisted men and 34 civilians. In order to fly 1,000 hr. in six months with a new piece of equipment, they will operate on an around-the-clock basis. All daylight hours will be spent flying, and some night flights are contemplated.

Maintenance crews will be on the job 24 hours a day. It will require five pilots for each aircraft to keep up the schedule.

Col. Hollis is confident on the eve of his first program that this one test, of the Sikorsky H-37A, will prove that the expense is justified.

Within a few months two new hangars will be constructed at Ft. Rucker to provide quarters. Meanwhile, the units have been operating out of a rehabilitated office building. For experience, some work has been done with the Hiller Hornet, YH-32 ramjet helicopter.

Aircraft Maintenance Bid

Ft. Rucker, Ala.—U. S. Army has asked for bids on a new maintenance contract to cover initially from 35 to 50 aircraft based here in three Army Aviation units separate from the Army Aviation School.

The aircraft will be flown by the Continental Army Command's Board 6 and the new Aircraft Test and Support Activity units now being established by the Signal and Transportation Corps.

Maintenance work on both fixed wing and rotary wing aircraft above the line maintenance performed by the crew chiefs, will be turned over to a private contractor. A new hangar will be constructed next year to provide quarters.

Hayes Aircraft Co. of Birmingham, Ala., already has a contract and performs maintenance on aircraft used here by the Army Aviation Schools. Hayes is one of the bidders for the new contract scheduled to go into effect early in 1957.

MODEL of Sikorsky S-60 flying crane has five-bladed rotor. Swivel seat enables pilot to fly facing forward or backward.

Sikorsky Designates Flying Crane S-60

New York—Sikorsky S-60 flying crane has a thin, elongated fuselage with cargo or pod space under the main rotor and widespread fixed landing gear with dual wheels.

Cockpit is forward-mounted and low slung. Innovation is a swiveling pilot's seat and windows on all sides of the cockpit including the rear. The seat allows the pilot to face aft when landing and have all of his cargo and most of his helicopter in full view. By backing the machine to a landing, he can spot his cargo with great precision.

Sikorsky has built a wooden mock-up of the machine. Scale is indicated by having a pond-sized fuel truck parked in the loading position.

The S-60 was described at the recent meeting of the American Society of Mechanical Engineers by Edward F. Katzenberger, chief development engineer, general design, for Sikorsky (AW Dec. 3, p. 28).

A second design shown also featured a long, thin fuselage with main and tail rotors and provisions to sling cargo or pods under the fuselage. Big difference is that the cockpit is slung under the rear part of the fuselage to give the pilot a unobstructed view of the cargo in front of him.

Katzenberger outlined these requirements for future helicopters:

They must have built-in inherent stability. The S-55 does not have it; the S-56 and S-58 have it to a degree.

Upcoming helicopters must have all weather suitability, which includes means of deicing the rotors. (The Marine Corps helicopters operating in Korea had no trouble with ice on the rotors, but they did not operate IFR. However, sufficient ice did accumulate on the tail cone to upset their center of gravity and require the pilots to land and remove the ice.)

To make helicopters suitable for shipboard operation and to help ground personnel camouflage the otherwise

CONVERTAWINGS flying crane entry has four turbine engines mounted at ends of booms.

hard to-conceal machines, automatic blade folding devices must be included. Currently under development the devices cost a weight penalty of 20% of the total rotor weight. A corollary necessity is a means of taxiing the aircraft with its rotors folded. This also costs weight.

The basic powerplant now being considered by Sikorsky for future designs is the Allison T56. As size goes up the number of T56s is increased. Current thinking goes as high as five T56s in one airframe. Rotor discs could go to 85 and 110 ft. diameters.

Another proposal for a flying crane is made by Convertawings, Inc., Amityville, N. Y. It consists of a four boom cruciform structure with a turbine engine and a rotor on each boom.

One version would use four General Electric T58 engines providing a total of 4,280 shp. and carrying a maximum payload of 10 tons and a normal load of six tons. Another using four T56 engines providing 10,600 shp. would carry a maximum payload of 26 tons and a normal payload of 18 tons.

The smaller version would have a 35.7 ft. rotor diameter for each of the four rotors, overall width of 61.5 ft. and would be dismountable to fold into space into a space 20x8x6 ft. The other would have a 56 ft. rotor diameter, a 96.4 ft. overall width, and would fold into a space 32x9x7 ft. Each would have a disc loading of 5.5 lb. per sq. ft.

David Kaplan, Convertawings president, said it would be theoretically feasible to build a flying crane of this type to carry a 50-60 ton payload using a rotor 80-100 ft. in diameter.

Two types of construction are visualized for the booms, either monocoque or tubular. The monocoque boom would have sufficient diameter to allow storage of the dismantled rotors inside for compactness in moving.

Navigational Ship Fitted Out For Firing Ballistic Missiles

New York—The Navy last week commissioned a navigational ship designed to provide the high degree of accuracy needed for firing ballistic missiles from shipboard.

The 17,600 ton U. S. Compass Island (EAG 153)—converted from a merchantman in five months' time—is capable of automatic photoelectric star tracking in daylight, gyroscopic measurement of latitude and accurate measurement of speed over ground, rather than the less accurate measurement of speed through water.

A second merchantman is now being converted to a navigational ship at Portsmouth Navy Yard.

Its mission will be the same as the Compass Island's. Although it has not been named yet, it will be designated EAG 154.

Used for Testing

Navy also expects to use the ships to test devices that will track radio stars and the sun and moon's radiation (AW Nov. 8, 1954, p. 43). We even expect this ship to be locating its position by taking radar ranges on the moon," Assistant Navy Secretary for Air Garrison Norton said.

The Compass Island's Ship Inertial Navigational System (SINS) is based upon research carried out by Dr. Charles S. Draper at Massachusetts Institute of Technology's Instrumentation Laboratory.

The Sperry Gyroscope Co.'s Marine Division is now refining the basic system and manufacturing first production units.

SINS determines latitude and longitude, true north and ship's speed over ground.

A special type of sonar equipment for measuring speed easier and more accurately was developed by General Electric Co. and Navy's Bureau of Ships.

It is housed in a large airfoil-shaped dome attached to the bottom of the ship's hull.

'Revolutionary Changes'

Celestial trackers mounted on a stabilized platform on a 67-ton tower just forward of the superstructure, will be used to check and correct SINS. The tower provides a rigid structure isolated from ship flexures to give fixed reference planes.

In addition to improving navigation devices and techniques the Navy hopes to "bring about revolutionary changes in the field of cartography."

The Compass Island once was the fast cargo ship, Garden Mariner. The Navy said it has the best automatic steering available and has activated fins for roll stabilization. This system was developed in the U. S. by Sperry Gyroscope.

When her sister ships are rolling 15 degrees the Compass Island will roll only about a degree and a half in the same seaway, Navy said.

Production of F5D Limited by Navy

Washington—Navy will not order production of the Douglas F5D Skylancer because of budget considerations, but has ordered development and testing of 11 models continued to the point where the Skylancer will become essentially an on-the-shelf item ready for procurement if necessary.

The number of test models was cut back to 11 from the original order for 19.

Two F5Ds have flown thus far. The other nine now are approaching the flight stage.

The F5D has substantially exceeded the Chance Vought F8U Crusader's 1,015 mph. Thompson Trophy speed record and has exceeded all performance specifications. It also has all weather radar capability which the Crusader does not.

The Douglas F4D Skyray experienced compressor stall above 50,000 ft. This has been avoided in the F5D by giving the inlet ducts finer lines. Minor control problems experienced earlier in the F5D's development have been corrected.

Gen. Orval Cook to Head AIA

Washington—Orval R. Cook, retired Air Force materiel expert will succeed Dewitt C. Ramsey as president of the Aircraft Industries Assn. in January. The AIA board of governors elected Cook to the presidency at their meeting in Phoenix, Ariz., in late November.

Ramsey will serve the remainder of his contract—until mid-1958—with AIA in the newly created post of vice chairman of the board of governors, functioning primarily in a consultive capacity.

At the governors meeting, Malcolm T. Ferguson, president of Bendix Aviation Corp., was elected board chairman for the first half of 1957. Whitley P. Collins, president of Northrop Aircraft Inc., will serve as chairman during the second half.

Cook's election to the AIA presidency confirmed Aviation Week's exclusive report on Aug. 27 (p. 28) that an active search was on to find a replacement for Ramsey. Cook was listed as among the leading candidates to succeed Ramsey by Aviation Week on Sept. 3 (p. 27).

Cook had a distinguished career as an Air Force officer prior to his retirement in May, 1956. He had served as director of procurement for the Air Materiel Command at Wright-Patterson AFB, as deputy USAF Chief of Staff for Materiel in the Pentagon and as deputy commander in chief of the U. S. European Command.

Regulus 2 Shows Supersonic Capability

Regulus 2 is a surface-to-surface missile developed for Navy by Chance Vought Aircraft Inc. designed primarily for launching from guided missile submarines such as the nuclear powered boats requested by Navy for its 1957 construction program (AW Nov. 19, p. 129). Regulus 2 is also planned for launching from steam catapults on carriers in a manner similar to that developed for Regulus 1. Flight tests of Regulus 2 are being conducted at the Air Force Flight Test Center, Edwards AFB, Calif. USAF is interested in Regulus 2 as an air-to-ground missile. Canard layout differs greatly from tailless planform of the subsonic Regulus 1. Powerplant is a turbojet fed from a chin-mounted inlet under fuselage. General layout indicates supersonic capability.

General Urges Crash Weapons Program

New York—All modern weapons programs should be crash programs, Maj. Gen. J. B. Medaris, commander, Army Ballistics Missile Agency, warned last week. He also pleaded for fundamental revision in our educational concepts beginning at the grammar and high school levels.

"The exceedingly rapid advance of science and technology, not confined to the United States requires that today's concepts be translated into deployed weapons in an absolute minimum of time," Gen. Medaris told the American Ordnance Assn.'s 38th annual Industrial Preparedness Meeting. "The alternative, which must be avoided, is the undesirable situation of having no current weapons only those which are obsolescent and those which are on the drawing boards."

Reference to rapid scientific advances not confined to the U. S. was an indirect recognition of the progress being made in Russia. And although Gen. Medaris would not comment upon the need for further acceleration of U. S. missile programs that implication was clear in his statement that "speed of progress demands that all programs in the complex modern weapons area be crash programs and telescoped to the maximum extent possible."

Gen. Medaris implied that the Army would continue to develop the Jupiter intermediate-range ballistic missile. He made the following points:

- **Defense Department approval** for IRBM No. 2 (Jupiter) in November 1955 "related only to the development aspect."
- **Recent roles and missions** clarification by Defense Secretary Charles E. Wilson (AW Dec. 3, p. 30), outlined "certain concepts for operational employment" and fiscal support of development programs. It did not change the responsibility for development.
- "The Army has a long history of serving others than itself, we have no prejudice about whom we serve in these matters."
- "Army's record of weapon systems deployed in the field per dollar invested is outstanding." First unit organized to use the medium-range Redstone ballistic missile, the 217th Field Artillery Missile Battalion, is in training at the Army Ballistic Missile Agency, Redstone Arsenal.
- **Jupiter** is "well advanced," using Redstone missile for flight test of components.

In sharp criticism of the nation's elementary and secondary school curriculum, Gen. Medaris said, "what is lacking is a technical atmosphere, a favorable climate in our grammar schools and high schools when boys and girls are in their formative years. They must acquire sufficient understanding of mathematics, chemistry and physics so that our high schools will produce adequate input of scientists to be for colleges and universities."

"The Army, no less than industry, can be equally prepared for possible conflict only if assured of a reserve of manpower to whom the basic principles of mathematics, chemistry, physics and electronics are just as familiar as the screwdriver, pliers and

Record Award to Missile Expert

His role in development of the Sidewinder missile brought Dr. William B. McLean, technical director of the Naval Ordnance Test Station, China Lake, Calif., a record $25,000 cash award last week under the government's Incentive Awards Program.

Navy estimates that Dr. McLean's efforts saved the government $5 million in the development program and $41 million in the production program, based on comparison with costs of other air-to-air missile programs. Sidewinder, conceived by Dr. McLean in 1949, has few moving parts and no more electronic components than a table radio.

The award was announced at the American Ordnance Assn. meeting in New York.

HR2S Modified For Radar Duty

Early warning radar carried by Sikorsky HR2S-1W makes a distinct chin outline for new version of the twin engine Navy helicopter. Radar is General Electric AN/APS-20E search gear for detecting low flying aircraft. Dorsal fin on cooling grilles on nacelles and concave-shaped fairing beneath rotor hub are other recent changes in the HR2S (AW Nov. 12, p. 29). HR2S-1W could be carried on escort carrier or other ship and flown to extend radar coverage.

automobile were to the inductee of World War II.

Another speaker before the association, Col. Richard Gibson, Headquarters, Air Development Center, Holloman AFB, told of problems in his field, instrumentation.

"The best efforts of industry," he said, "are seemingly not sufficient in many instances to assure acceptable performance in time for operational use. This applies across the board to our development program, but in no case is this more applicable than in the instrumentation area."

▪ **Bomb sights.** Great strides have been made in advancing the capability of bomb sights. Economy of operation has dictated that bomb accuracy should not be traded off for high yield war heads. Maintainability and reliability are current headaches, but can be licked.

▪ **Navigational instruments.** Most promising area of development is the self contained inertial guidance system. Much yet remains to be done in reducing weight, increasing accuracy and developing new and better inertial sensing devices.

▪ **Flight instruments.** Two serious problems in current. How best to present flight information to the pilot? Today's cockpits show much redundant information. How can this be condensed into more meaningful form? Second, how to obtain instruments which have the requisite accuracies over the large ranges of induction required in today's supersonic high-flying planes?

▪ **Range instruments.** Two major problems are accuracy of recorded data, and delay in reducing data.

At Holloman, position data with an accuracy of plus 10 ft. can be delivered in 7-10 days.

Telemetered data on internal functioning of a missile may take weeks or even months to reduce to an accuracy of 1-5%.

• **Components.** Missile systems' clean-up may be delayed for years due to unsatisfactory components.

One of Holloman's primary aims is to develop an automatic system which will present suitable flight test results almost instantaneously, to cut data reduction time. An important factor is the high cost of maintaining engineering and flight test staffs while awaiting flight test results.

Avionics equipment must be further subminiaturized. Every gain in this direction is promptly cancelled by the addition of more channels.

Another unsolved instrument problem at Holloman. There is no suitable miss distance indicator for use with tests against airborne targets.

The command is now tackling the problem of instrumenting a high speed sled track facility involving extreme accelerations and sled vibrations of which the frequency spectrum is yet unknown.

Col. Bernard R. Luczak, USA White Sands Proving Grounds, told the meeting that present range instrumentation must become more accurate and data reduction must be speeded up many fold.

Reason is the ever increasing work load. The number of actual missile firings at the White Sands Proving Grounds Integrated Range has doubled each year for the past three years and the end is not in sight.

The facility is running over 400 missions of various types including firings, per month. Faster, higher, smaller missiles are being flown oftener by increasingly capable scientists and engineers who need better data and who need it faster.

In several activities at White Sands the specter of saturation is very real.

In the field of electronics the technique of furnishing missile trajectory data in real time (instantaneous) from unmanned stations is here now on a limited scale.

Temco's New Drone

Navy has awarded Temco a contract for development of XKDT-1 target drone capable of operating at sonic speeds and altitudes of more than 50,000 ft. Swept wing drone can be launched from carrier based aircraft that are equipped to fire air-to-air missiles. Low cost expendable rocket will appear as large as a fighter on radarscopes. It will have self contained guidance system and will maintain constant course and altitude during its powered flight of more than eight minutes. Extensive test program is planned at Naval Air Missile Test Center, Point Mugu, Calif. Target will eject flares during flight to facilitate visual tracking.

CAB Members, Staff Tour Jet Plants

Los Angeles—Jet transports will spell cheaper, safer and faster travel for more people, James R. Durfee, chairman of the Civil Aeronautics Board, predicted during a tour of West Coast jet transport manufacturing facilities for initial discussions of operational developments of large turbine powered aircraft.

Durfee was accompanied by CAB members Joseph P. Adams (vice-chairman), Chan Gurney and Harmar D. Denny, and 14 officials representing the Board's safety regulation, safety investigation, air operations, legal and public information staffs.

During a brief press conference aboard the Boeing 707 jet transport after it had landed here in a flight carrying the group from the Boeing plant in Seattle where first discussions were held, Durfee said that the new jets, with their high speeds cutting travel time, would save business men billions of dollars a year.

Durfee remarked he was satisfied that necessary revisions and regulations pertaining to safety and economics of jet transports will be ready when these planes go into service. "There will be no time lag," he said.

Gurney added that he hoped the necessary navigation instruments would keep pace with the manufacture of jet transports.

The flight in the 707 was Durfee's first in a jet plane. He sat in the co-pilot's seat, he said, and witnessed the plane's maneuverability. Every member of the Board and staff, he added, was pleased with the 707's maneuverability, speed, relative quiet, absence of vibration, and comfort.

The flight from Seattle to Los Angeles, a distance of 1,007 air miles, took two hours and four minutes. Highest true airspeed was 590 mph., average ground speed 500 mph., average wind was 75 mph. headwind at 200 deg. Cruising altitude was 35,000 ft.

In this area, the CAB members and staff conferred with Lockheed Aircraft Corp. officials on the Electra turboprop, and Douglas Aircraft Co. officials on its DC-8 jet transport.

The group then visited Convair Division of General Dynamics Corp. at San Diego for similar discussions on the company's forthcoming 880 jet transport.

Conference with Fairchild Aircraft Division of Fairchild Engine & Airplane Corp., Hagerstown, Md., on its F-27 Friendship also was scheduled by the group.

KC-135 Carries Out First Refueling

Aerial refueling tests have begun for Boeing's KC-135 jet tanker-transport. Initial tests were carried out with Boeing B-52, which is without usual tail turret in photograph. First production model of the KC-135 will be delivered to Strategic Air Command's Castle AFB, Calif., next spring. Castle will become center for refueling training for SAC, and 93rd Bomb Group, commanded by Brig. Gen. William F. Finbank Jr., is at the present time organizing training cadres. Boeing Aircraft Co. has been ordered by USAF to increase KC-135 production to 20 aircraft per month.

Smaller Vertical Tail Considered for B-52

Seattle—Boeing Airplane Co. is conducting wind tunnel studies of a smaller vertical tail for the B-52 Stratofortress bomber as one of a number of possible ways of increasing performance by cutting weight and drag.

The fin's unusual height of approximately 30 ft. was aimed at increasing engine out and cross wind landing performance.

Apparently the cross-wind landing gear has proved successful enough for Boeing to feel that the B-52 might get along with a reduction in tail size—possibly as much as one fifth.

North American Says Sales Up, Profits Down

Los Angeles—North American Aviation Inc.'s net income declined by approximately $3.5 million during the fiscal year ending Sept. 30 despite the highest net sales in the history of the company.

Net sales for the year were reported at $913,981,913; net income after federal income taxes was reported at $28,760,962.

For the 1955 fiscal year, net sales were $816,676,329, net income, $32,349,176.

The 1956 figure was equal to $3.59 per share on 8,015,077 shares of capital stock outstanding on Sept. 30 as compared with $4.04 a share for the preceding fiscal year.

J. H. Kindelberger, North American board chairman, attributed the loss in net income to an expansion in company sponsored research and development work, with a larger proportion of research and development activity for the government being carried out under cost type contracts.

In a report to stockholders Kindelberger reported North American's backlog of unfilled orders as of Sept. 30 at $1,285,000,000 as compared with $1,156,000,000 for 1955.

For the fourth quarter of the fiscal year, total sales and other income totaled $280,829,799 to produce a net income of $6,438,110.

Capital additions, again the highest in company history, totaled $23,683,099 for the year. The 1955 total was $11,334,958.

The new company facilities include a wind tunnel at the Columbus, Ohio, division and a $5 million transonic tunnel now nearing completion at the Los Angeles plant.

Total floor area at all of North American's divisions increased by 15% over 1955 for a total of approximately 11 million sq. ft. in use by the end of the fiscal year.

Employment during the year increased by almost 10,000—from 61,335 to 70,750.

Total wages, salaries and other types of compensation jumped 20% to $388,800,000, with average earnings of hourly paid employes reported at $95.02.

USAF Investigates Third B-52 Crash

Washington—Preliminary investigation of the crash of a Strategic Air Command B-52 Stratofortress near Castle AFB, Calif., on Nov. 30 indicated no relation to either of two other B-52 crashes this year.

The crash, which killed six crewmen and four instructors, did not result in an order to ground B-52s as the second crash had.

Cause of the first crash was failure of a turbine wheel used to drive an alternator. Cause of the second also was laid to the electrical system, but it has not yet been pinpointed (AW Dec. 3, p. 31).

Earliest reports indicated no aircraft failure in the third accident.

Convair Will Convert Test Versions of F-102A

Convair Division of General Dynamics Corp. has received a USAF contract to modify a number of test versions of the F-102A all-weather fighter to operational tactical versions. First of the aircraft, which eventually will be assigned to the Air Defense Command, will begin arriving at Convair-Fort Worth some time next month.

USAF Experiments With Program Aimed at All-Jet Flight Training

By Erwin J. Bulban

Laredo AFB, Tex—Experimental jet training program being evaluated here by USAF's Flying Training Command is aimed ultimately at developing a curriculum providing USAF pilots with all-jet experience beginning with primary training.

The program also is expected to have important implications for the present primary pilot training program conducted for the Air Force by nine civilian-operated contract schools.

Two experimental classes now at Laredo AFB have made a transition directly from the small Beech T-34A Mentor piston-engine primary trainer to the Lockheed T-33A jet, skipping the customary T-28A piston engine trainer phase comprising 90 flying hours. One group flew the normal 40 hr. of T-34A primary time, the second class 80 hr. in the Mentor. A third group still to come, will have 120 hr. of T-34A time before arriving here.

Immediate Effect

FlyTAF officers say it is too early to determine the immediate effect on the primary basic pilot training program. First Cessna T-37A jet primary trainers are scheduled to arrive at the contractor's schools next fall (AW Dec. 3, p. 34). Students may then start with the T-34A, go to the T-37A, then to the T-33A. Eventually, they may begin with the jet T-37A and then go to the T-33A. It appears that the North American T-28A will be eliminated as early as possible. How much flying time the student will spend on each type also is yet to be determined.

A FlyTAF spokesman emphasized that the experimental program, which shortcuts a phase of training handled by the civilian contract schools, is not aimed at lessening the contractor's future responsibilities in the Air Force training program. FlyTAF feels that changes in training programs are always imminent in order to keep up-to-date with trends. FlyTAF is just feeling its way along in this course to develop necessary new techniques, with no axes to grind, the spokesman said.

The initial experimental class received 55 hr. flight indoctrination on the T-33A, is scheduled for 30 hr. of formation flying, 25 hr. navigation, 12 hr. aerobatics and 5 hr. of instrument time. Second class is receiving 45 hr. indoctrination, 30 hr. formation flying, 20 hr. navigation, 10 hr. aerobatics, and 35 hr. instrument time. All students on this experimental project were drawn from Beverly Howard's Air Force contract school at Spence Air Base, Moultrie, Ga.

Students were chosen to include both average and above average types to keep the evaluation from being weighted. Those that pass the course will continue through the rest of the training program to squadron assignment with evaluation of their proficiency continuing to measure the effects, if any, of their experimental training. Washouts will have an opportunity of going back to the contract schools to pick up where they left off their conventional training.

Student Opinion

What do instructors and students think of the project? General consensus gathered by AVIATION WEEK during a visit to Laredo was that it was a fine program. One student, Lt. Donald J. Tweedy, made his first solo flight in a T-33A after only 56 hr. 5 min. total flying time, including 40 hr. on the T-34A. The average student in the experimental program is soloing the T-33A in 17 or 18 hr., five or six hours later than he would had he undergone his full 130

First Pictures of Fauga's Makalu

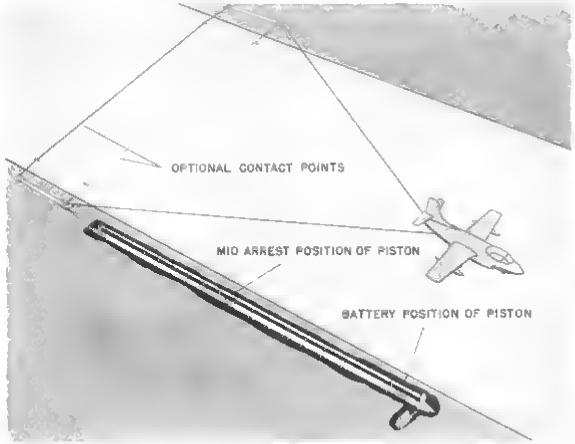
CM 171 Makalu is flying test bed for Turbomeca Gabizo engines rated at 2,425 lb. thrust each (AW Nov. 12, p. 32). Developed by French firm of Fouga, the Makalu is basically a CM 170 Magister trainer with modifications to take the larger powerplants. Plane logged five hours flight time in ten days after first flight last month. On one test it climbed to 40,000 ft. in nine minutes and 20 sec. measured from the time of brake release for the takeoff run.

hr on the two types of piston-engine trainers. Of the T-33A, Tweedy says, "It's great." And he thinks the class will be much better off in experience than their classmates who will make the transition to jets from the T-28A.

An instructor noted that the students are really trying hard, most of them are about three hours ahead of schedule. All jet training will actually cut down FltTAI's washout rate because it will eliminate some of the apprehension caused by the switch from piston types to jets the instructor said. Personally, I get nervous flying a piston-engine aircraft," he said. "There are too many parts, too much vibration, too much chance for things to go wrong." He said the experimental flight had lost two students probably because of apprehension caused by the switch from piston-engine planes to the T-33A.

Efficiency is expected to go up with the arrival of additional training equipment, such as 15 T-33A simulators which are scheduled to arrive at Laredo AFB in June. There have been some slippages in this program, he noted. The simulators will reduce time now consumed by students going to and from the line for T-33A indoctrination, will also release airplanes to flying and maintenance.

Laredo AFB, one of the Air Force's five basic single-engine pilot training schools was chosen to conduct the experimental program because it is the focal point for training analysis and development under direction of Maj. E. E. Middleton.



SHORT field arresting system uses cable attached to piston in water filled pipe.

'Water Squeeze' Barrier Tested

Washington—All American Engineering Co.'s TM-4 transportable water squeezer arresting gear has been successfully tested by the Navy and Marine Corps, and a production contract is expected after certain improvements are made.

The new gear has stopped the Douglas A3D, Douglas T3D, Grumman T9T and North American AJ Savage in tests at All American's Georgetown, Del., base. The company said the arrester has stopped a landing Marine jet fighter in less than 100 yards without damage to the plane or to the gear.

The arrester is called expeditionary because it is the first that can be dismantled, packed into helicopters or cargo aircraft and set up within a few hours at fields with runways as short as 1,000-2,500 ft. It does not require a permanent concrete installation to anchor it to a runway.

All-American's "water squeezer" principle is used to prevent steam catapult bridles on aircraft carriers from going overboard at each launching. It also is used on the high speed test sled project at Hurricane Mesa, Utah.

The arrester consists of two cables in case the plane's tail hook misses the first, a tapering water-filled pipe sunk into a ditch a few feet deep along one side of the runway, and a cable retrieving system.

The cables are attached to a loose-fitting piston at one end of the pipe. When an aircraft engages the cable, the piston is pulled through the pipe until the forward motion of the aircraft is stopped.

The nickname comes from the fact that the piston appears to "squeeze" the water.

A small gasoline engine powers the cable retrieving gear. All-American cited the simplicity and minimum of maintenance required, and said no adjustment is necessary for different landing weights and speeds.

All American is experimenting with "water squeezer" arresting gear for use with multi-engine bombers and transports.

Its arresting gear for heavy fighters being developed under an Air Force contract (AW Nov. 12, p. 26) is now undergoing tests.

Army Will Evaluate Twin Pioneer Model

Washington—Army will evaluate Scottish Aviation, Ltd.'s short takeoff Twin Pioneer within the near future. A single-engine Prestwick Pioneer hit soft sand and flipped over at Ft. Bragg, N. C., two and a half weeks ago—just two days short of completion of an Army evaluation.

The Twin Pioneer has been flying since June 1955. It can lift 16 persons from a 250-yard strip, Scottish Aviation said.

The company plans floatplane and freighter versions. The aircraft is powered by two Alvis Leonides 503/5 engines.

Damage to the single-engine Pioneer was great enough to halt tests, but the aircraft was not destroyed. It has been returned to Scotland for overhaul.

The manufacturer says it can take off fully loaded within 75 yards, or 180 yards if it needs to clear a 50-ft. obstacle. The Royal Air Force is using the aircraft, which is powered by an Alvis Leonides 502/4 engine.

New Coupling Device Cuts Time, Saves Fuel

Wright-Patterson AFB, Ohio—Coupling device that cuts probe and drogue refueling time of tactical fighters by approximately 75% and reduces spilled fuel to 1/16th of that now encountered has been developed for the Air Force by its Air Research and Development Command.

The coupler can increase maximum fuel flow from 300 to 1,200 gal. per minute.

This is the first standardized Air Force refueling coupler. It will be used on future probe drogue tactical fighters, ARDC said, and also is available for Navy use.

News Digest

Initial production order for the English Electric P 1 fighter was placed by the Ministry of Supply. Fighter is first British aircraft capable of supersonic speed in level flight to go into quantity production. Development order of 20 was placed two years ago, and deliveries of these are expected to begin in the next year.

Titanium Metals Corp. of America reduced price of titanium mill products 6-8%. Reduction is second this year, fifth since February 1954. Sheet is down $1 a pound, strip a minimum of $1.10, plate 75 cents and bar and billet 55.75 cents.

United Aircraft Corp. increased salaries of about 16,000 salaried employes 5%. Increase covers all divisions of the corporation.

Marquardt Aircraft Co., Van Nuys, Calif., has been awarded Air Force contract for $2 million representing initial release of funds for construction of supersonic ramjet production test facility about 15 mi. west of Ogden, Utah. Marquardt also is building ramjet manufacturing facility at Ogden, scheduled for completion early next year, to produce powerplants for Boeing Bomarc interceptor missile.

Initial Assignment of Lockheed Aircraft Corp.'s F-104A Starfighter will be to key installations of the Continental Air Defense Command. The F-104As also are projected for future duty with the Air Force's Tactical Air Command. In addition to the F-104A, the two-seat F-104B also is in production and a photo reconnaissance version is being readied.

Strength of four of the 12 Nike missile sites around Philadelphia is being increased by adding 12 firing positions to current 12.

Atomics International, Division of North American Aviation, is carrying on a design study for the Atomic Energy Commission of an advanced type atomic power plant to propel a large marine tanker.

Strike of 420 machinists at Palo Alto, Calif., plant of Hiller Helicopters, Inc., has shut down production. Walkout began after old contract expired Nov. 30 with company and union 5 cents apart on wage issue.

Weber Aircraft Corp. received million dollar additional order for upward ejection seats for the Boeing B-52.

Russia's Madge Patrol Plane

Similarities to Martin PBM Mariner flying boat are apparent in high gull wing, twin tail with dihedral and heavy fuselage of model of Russian Navy long-range patrol plane. NATO code designation is Madge. Engines appear very large. Madge has approximate gross weight of 50,000 lb., wingspan of 100 ft., top speed of approximately 165 kt.

International Lines Resume Cairo Stop

Egyptian government limits international service to four carriers, rebukes Britain, France.

By L. L. Doty

Washington—Restitution of air service into Cairo has been restricted by the Egyptian government to four international airlines.

In a sharp rebuke to British and French national carriers, Egypt invited only Trans World Air Lines, Swissair, KLM and Scandinavian Airlines System to restore air links between Cairo and the U. S. and Europe. Virtually all service was brought to an abrupt halt by the British and French ultimatum on Oct. 30.

Prior to the Israeli invasion of Egypt on Oct. 28, a total of 30 airlines, including 10 Arabian national carriers, operated into the busy airports serving Cairo. And the city's service was not entirely cut off during the fighting. Air Jordan and Saudi Arabian Airlines for example, are reported to have continued sporadic service into and out of Cairo throughout the Port Said invasion.

New Cairo Schedules

Here is how the four airlines scheduled their flights into Cairo by the end of last week:

- **TWA** was granted State Department permission to reinstate Cairo flights after a Civil Aeronautics Administration survey team inspected and approved buildings and runways at Cairo International Airport. The airline was scheduled to begin a token turnaround service to Cairo yesterday with four flights a week. Through flights to the Far East are being rerouted via Istanbul, overflying Cairo and Tel Aviv.
- **Swissair** has been operating three flights each week between Athens and Cairo since Nov. 25. The airline canceled its Cairo service on Oct. 28. However, Swissair, under contract to the United Nations, operated three DC-6Bs in a shuttle service between Naples and Cairo from Nov. 15 to Nov. 25, transporting 1,220 emergency force troops and their equipment into Egypt. Cairo is a regular terminal point on the company's system.
- **KLM** was the first airline to resume commercial service into Cairo. The airline resumed service on Nov. 18 from Amsterdam through Rome to both Cairo and Beirut on a three times a week basis. Beirut and Cairo are temporary terminal points for the airline and no passport or Far East flights which make a technical stop at Khartoum.
- **SAS** schedules have reached an almost normal status and the airline is operating its Far East service through Cairo on a regular schedule of three times a week. The airline reports very heavy Cairo traffic, which according to a company spokesman, appears to be unrelated to military or political activities in the area. Old companies he advised are reported to be renting their personnel in the Middle East in a routine fashion.

The CAA team flew into Cairo on Dec. 3 and spent three hours surveying the airport. Damage was reported to be slight, although one runway had been damaged by bombs. The four airlines reported that their ground equipment and other facilities were undamaged.

All four airlines are confining operations to daylight hours as a protective measure. With the exception of SAS, the airlines are operating quick turnaround flights. TWA's four flights a week will spend a maximum of one hour on the ground at the Cairo airport. KLM has scheduled its three flights a week to arrive at Cairo at 8 a.m. and depart at 9 a.m.

An operational problem facing the airlines is an air corridor entry into Cairo established by the Egyptian government. The corridor is one of the chief reasons why KLM, Swissair and TWA do not want to schedule Far East flights through Cairo.

All airlines are conforming with an Egyptian order denying entry into Egypt to English, Canadian, Australian and French nationals. Although Egypt has assured the airlines that in transit passengers of these nationalities will be allowed to pass through Cairo en route to other destinations, SAS is discouraging such passengers from taking the risk.

Tel Aviv Operations

Tel Aviv experienced no complete disruption of service although Air France sharply curtailed schedules into Israel. KLM, Sabena, Swissair and SAS suspended service for a short time only. El Al Israel Airlines maintained uninterrupted service throughout the hostilities but a decided drop in traffic was reported by a company official.

El Al Israel is expected to suffer further this year from the expected loss of the normally heavy Christmas traffic into Jerusalem. Even before the Israeli-Egyptian war began the financial footing of the airline was unsteady and plans were being considered to seek foreign capital since the Israeli government was unable to offer financial aid.

Cyprus Airways operated DC-3s for the first two weeks of the crisis from Cyprus to Tel Aviv in place of the normal Viscount service. It offers in cooperation with British European Airways Viscount schedules have since been restored.

Trans World Air Lines discontinued its Tel Aviv service on Oct. 28. It resumed service last Friday when the State Department revalidated American passports which it previously had canceled for Israel, Egypt, Jordan and Syria.

Passports for TWA crews scheduled for the Cairo run were not revalidated by the State Department until assurances were received from the CAA that the airline would encounter no operational difficulties at the Cairo Airport.

TRUCK convoy carried TWA employes from Alexandria to Tobruk during Egyptian crisis

Cairo Evacuation

TWA's pre-planned airlift evacuation of its 213 American personnel based in Cairo was canceled when Egypt closed the country's airports to civil aviation on October 28. All but six of the airline's employees joined a truck convoy arranged by the U. S. Embassy for evacuation of 1,800 American citizens. The evacuees were transported to Alexandria harbor where they boarded three Navy attack transports for Crete.

The remaining six—led by Joseph W. Letzkus, TWA vice president in Cairo and his assistant Roger Chase—remained behind long enough to appoint a group of seven Egyptian nationals who are TWA department heads to serve as a caretaker management team. All the company's equipment records as well as personnel's personal property, were placed under the custodianship of the caretaker group.

The group successfully managed all of TWA's affairs during the absence of American officials from Nov. 12 when the six evacuated to Tobruk, Libya by truck, to Dec. 2 when they returned on the CAA survey flight.

Flights to Far East

Immediately after the Israeli attack, TWA conducted three proving runs under the jurisdiction of CAA officials to determine best possible routes to the Far East circumventing Israel and Egypt. The route from Athens to Basra via either Cairo or Tel Aviv was diverted via Istanbul, Ankara, El Azig and Baghdad.

CAA adviser Hiram Broiles rode as a crew member on the first and second flights over the new route, while William Cunningham monitored communications from TWA's dispatch center in Rome. The proving flights demonstrated the impossibility of maintaining point-to-point control of the flights and, upon CAA's recommendation, TWA established a dispatch center in Basra to control the Basra-El Azig leg of the route, with Rome controlling the Athens-El Azig portion.

The third proving flight showed this to be a practical and safe operational procedure.

TWA does not contemplate opening the Cairo-Basra route within the near future and will route eastbound passengers from Cairo to Athens on the shuttle. From there, they may connect with flights to the Far East.

Carter L. Burgess New TWA President

Carter L. Burgess resigned last week as Assistant Secretary of Defense for Manpower, Personnel and Reserve to become president of Trans World Airlines. He succeeds Ralph S. Damon, who died Jan. 4.

Burgess will assume his duties as chief executive officer of the airline, member of the board of directors and member of the executive committee early in 1957 following completion of government projects in which he is engaged.

Burgess, who served as secretary of the General Staff for SHAEF during World War II, became assistant to the president of TWA in 1946. The following year he joined General Airline and Film Corp. as director of administration, where he remained until 1953. In 1954, after serving as a consultant to President Eisenhower on White House staff organization and Cabinet organization, he was appointed to the Defense Department.

Swissair was asked by the United Nations on Nov. 9 to conduct charter flights to Egypt. A contract was signed on the following day at U. N. Headquarters in Geneva. Some 35 hours later, the airline had moved a group of 100 flight and ground personnel to Naples and three DC-6Bs under the supervision of Capt. Karl Schaefer, chief pilot for Swissair in the Near East.

Aside from removing carpets and catering equipment, the aircraft were not modified for the shuttle. The planes were withdrawn from regular service without disrupting the airline's schedule pattern.

One of the DC-6Bs had been earmarked for the Swiss Olympic team which canceled its trip to Melbourne a few days before the Olympic Games opened in protest against Russia's intervention in the Hungarian revolt.

A second DC-6B was available because of the suspension of Cairo service, and a third, scheduled for Geneva-London service, was replaced by a Convair 440. One half of the airline's DC-6B fleet was assigned to the Cairo shuttle.

Although the charters were scheduled to begin on Nov. 13, disagreements between the U. N. and Egypt over the composition and authority of the U. N. police force delayed the operation until Nov. 15. No more than three flights a day were possible since Egyptian authorities refused entry of any aircraft into Egypt after 4 p.m. Swissair also has agreed to operate another series of shuttles for the U. N. between Dec. 6 and 15.

British Overseas Airways has been avoiding the Near East since the Israeli attack on Egypt. Routes to Africa are diverted via Rome and Khartoum or via Tripoli (AW Nov. 5, p. 41). Far Eastern flights are being rerouted through Istanbul and Basra. BOAC reports no disruption of service on any part of its system as a result of the Near East crisis.

None of the British airlines are anticipating a curtailment of service as a result of gas rationing. British European Airways however has canceled its Birmingham-Leicester-Birmingham helicopter service as a fuel conservation measure.

Ethiopian Airlines service between Athens and East Africa has been rerouted through Benghazi, Libya to avoid the Middle East trouble.

According to a company sales official, flight frequency on the Athens-Addis Ababa route has been increased from four to six flights each week in order to meet the demand for space created by the emergency.

Ethiopian Airlines is the only airline reporting a traffic increase that is directly attributable to the Middle East crisis.

Chesapeake & Ohio Railway May Buy Interest in Slick Airways

Cleveland—Chesapeake and Ohio Railway would invest $1.3 million in the future of an freight under terms of a deal with Slick Airways under negotiation for six months and nearing completion last week.

The railroad money is expected to go into a $5 million issue of 10-year debentures by the air carrier with C&O receiving, in addition 70,000 shares of Slick common stock (850,000 are now outstanding). The debentures are convertible into common stock after Jan. 1, 1959. Earl F. Slick and other members of his family, who now own 39% of the stock, would pick up the remaining $1.7 million of debentures and retain control of the company.

The deal would help Slick to purchase six new DC-6As, improve ground facilities and it also might provide a valuable service and sales team with the railroad's network.

'C&O is impressed with the prospects of an freight and with the ability of Slick Airways to share in that growth,' the rail line's president, Walter J. Tuohy, said. 'Slick has out-

standing management and 10 years experience in the industry, and we feel there is much to be gained through contact between the management of both companies and the sharing of information."

Slick made the approach, and Slick's Board Chairman Delos W. Rentzel says, "it is no coincidence we went to the progressive C&O" for financial support in the airline's expansion plans.

The railroad's president believes that rail, air, water and highway carriers are interrelated in the overall transportation system. He calls the Slick deal "a companion step" to C&O's purchase of the Washington and Old Dominion Railroad, its partnership in American Coal Shipping, Inc., and its development of Railvan, a convertible rail-highway truck which might offer possibilities of combination with air carriage.

Air-minded C&O has leased a DC-3 and bought a Piper Apache for use by its traveling executives.

Both Interstate Commerce Commission and Civil Aeronautics Board have been informed of the proposed purchase. It is unlikely that CAB will be formally approached until the deal is closed, if then, since the railroad would hold only a minority interest in Slick. Regulations forbid control of the stock of one common carrier by another.

While other railroads have been working more closely with airlines—Southern Pacific's ticketing and reservations arrangement with United Air Lines, for example—outright investments have been rare since the CAB Act of 1938 forbade control.

In the 1920s and 1930s, however, railroad money controlled air carriers in some cases. Two examples: Pennsylvania Railroad was majority stockholder in the present Trans World Airlines, and three New England railroads owned Northeast Airlines for a time.

East German Airline's Imitation Worries West German Lufthansa

Bonn—East German Lufthansa, growing rapidly since its first regular operations early this year, is causing increasing concern to its West German counterpart by continued use of the Lufthansa name and even identical markings on the tails of its aircraft (AW Aug. 6, p. 461).

Western carriers who have entered into agency agreements with East Lufthansa are seeking to answer West Lufthansa's protests by finding a way to sell East Lufthansa tickets without violating trade name rights.

Although the East German government claims the East Lufthansa has been registered as a joint stock company with a basic capital of $7.5 million since 1953, western observers believe this early date is given officially only to justify usurpation of the internationally registered name "Deutsche Lufthansa" under which the West German carrier is operating.

Actually, East Lufthansa started flying regular routes only in the beginning of 1956. In October 1955 East Lufthansa had only one plane. This number has been increased to a dozen or more (no accurate information is available).

By the end of next year, the carrier plans to operate 60 planes; in 1960 jets are scheduled to arrive for the planned East Berlin-Peking route.

First news about a regular flight connection of East Lufthansa came in February 1956 when a route between East Berlin and Warsaw (Mondays and Thursdays) was established. In May, two other international routes were added: East Berlin-Sofia (Mondays and Wednesdays) and East Berlin-Bucharest (Saturdays), both with landings in Prague and Budapest. In the meantime, an additional connection, East Berlin-Moscow, has been established and for 1957 two main routes from East Berlin to the Thuringian and Saxonian industrial areas are planned with air taxi feeder services.

All planes used by East Lufthansa are of Russian origin. They are primarily the Ilyushin 14, which has about 30 seats. Other types used are the twin-engined Il-2 with about 20 seats, the Il-12 with 30 seats, and the four-engined Il-18 with 60 seats.

East Lufthansa is state owned and reports directly to the Ministry of Interior Affairs of East Germany. The director is Arthur Pieck, son of Wilhelm Pieck, president of the East German government. The chief director is appointed by the Ministry of Interior Affairs and appoints in turn the top executives of his organization, who have to be approved by the Minister of Interior Affairs. The pilots are Russians. Rest of the personnel—as far as non-political jobs are concerned—are said to consist primarily of former members of the old German Lufthansa.

KLM Royal Dutch Airlines reportedly has reached a general agency agreement with East Lufthansa to sell the carrier's tickets in KLM offices. Similar agreements are said to be under negotiation with Scandinavian Airlines System, Swissair and Air France. West Lufthansa has contacted these carriers and strongly protested against its patented name being used in the western hemisphere by another airline. West Lufthansa does not object to a ticket sales agreement as such.

PAA, TWA Favored For Polar Routes

Washington—Competitive U. S. flag air service on the West Coast-Europe polar route was recommended last week by Civil Aeronautics Board Examiner William J. Madden.

Madden advised the CAB to permit Pan American World Airways and Trans World Airlines fly the polar route to Europe from Los Angeles and San Francisco and to add Seattle to Pan American's polar route.

Service by the two U. S. flag airlines would give Scandinavian Airlines System its first competition on the highly successful route between Southern California and Europe and would give the American carriers a share of a market which eventually will be served by British and German airlines.

The examiner found that service by two American carriers is easily justified by the substantial travel market between the West Coast and Europe. He also said the U. S. airlines need the direct routing to attract a share of the market.

During the CAB hearings on the case, Pan American and TWA did not oppose one another's applications, maintaining that there is room for two U. S. carriers on the route.

Madden recommended that the Los Angeles-San Francisco-Europe authority be issued as permanent certificates, basing his opinion upon the imminence of bigger, longer range aircraft that will make the long-haul operation economical.

He also found that permanent authority would encourage investment in such modern equipment.

Pan American was chosen for temporary authority to serve Seattle because the carrier is already established there and would be able to combine the polar service with present operations. Seattle was favored over Portland as the point to be served in the Pacific Northwest because both Seattle and the state of Washington produce more traffic for Europe than Portland and Oregon.

The examiner advised the CAB to make the West Coast points separate co-terminals on Pan American and TWA's routes to Europe, rather than including them with the airlines' East Coast co-terminals.

Classifying the points as separate co-terminals would keep the carriers from serving both West Coast and East Coast points on the same flight to Europe.

Northeast Orders Britannia Turboprops

Boston—Northeast Airlines last week became the third U. S. carrier to turn to the British turboprop market when it signed a contract for five Bristol Britannia 305 transports at a cost in excess of $17 million.

Delivery of the first three Britannias is scheduled for next October. If met, this will permit Northeast to schedule the turboprops over its recently acquired Boston-Miami route in time to meet the seasonal upsurge of traffic during the 1957-58 Florida vacation period. The remaining two aircraft will be delivered in December 1957.

The carrier will become the second domestic airline to offer turboprop service if deliveries hold to schedule. Introduction of the Britannias will follow inauguration of Capital Airlines Viscount service by more than two years.

Continental Air Lines, which has ordered 15 Viscount 810/840 turboprops, plans to begin service in the spring of 1958. Both Eastern Air Lines and American Airlines are scheduled to receive Lockheed Electras in late 1958.

In Washington, Civil Aeronautics Administration officials foresee no difficulties that might delay certification of the Britannia. A CAA Type Board meeting was held last summer to request data required to begin certification processes. At present the CAA is preparing special conditions that will be required for U. S. certification of the Britannia. These conditions will be transmitted within the next few weeks to the British Air Registration Board through CAA's Paris office.

Financial arrangements for the purchase of the Britannias have not been completed, according to Robert Turner, Northeast vice president of sales. Available funds have been earmarked for the purchase of 10 DC-6Bs at a cost of $16.5 million, and presumably it will be necessary for Northeast to raise additional capital for the Britannia order.

Last month, the airline filed a registration statement with the Securities and Exchange Commission for a new stock issue to raise a net of $7 million. The airline also has a stand-by credit with a bank group headed by the Chase Manhattan Bank of New York for $11 million. Of this amount, $2,870,000 already has been borrowed.

Since the bank credit expires on Dec. 31, Northeast is using the balance of the loan and the funds to be raised by the stock issue for the DC-6Bs so that the Florida route can be inaugurated early next year when delivery of the first DC-6Bs is scheduled to begin.

Negotiations between Northeast and Trans World Air lines for a short term lease of six Lockheed Constellations were not successful. Northeast wanted the aircraft to accelerate inauguration of the Florida route, but discussions between the two airlines have been dropped.

Talks with Bristol began early in October (AW Oct. 8, p. 43) but were delayed because of intake icing problems in the Britannia's Proteus turboprop engines (AW May 14, p. 30).

Turner told Aviation Week the airline delayed negotiations pending solution of the problem and added that "latest tests have proved beyond our satisfaction that the flameout trouble has been licked."

George Gardner, Northeast president, said the Britannias will be used in first-class service on the new routes to Florida. Northeast also plans to introduce day and night-coach service on the Florida route with piston aircraft.

Gardner said the Britannia was chosen because it is "available" two or three years ahead of any comparable American-made transport.

He said negotiations with Bristol also included "plans for the purchase of additional planes."

The Britannia 305 is powered by four 755 Proteus turboprop engines developing 4,120 total equivalent horsepower or 3,650 shp. plus 1,220 lb. thrust. The engine employs the free turbine principle in which two turbines drive the compressor and another two drive the propeller.

Bristol says this principle provides greater economy, less vibration and less noise and gives the pilot wider range to change propeller rpm. without changing compressor rpm., since the only link between the turbines is the jet stream. The 16-ft. four-bladed propellers are manufactured by de Havilland.

Maximum gross weight of the Britannia 305 is 175,000 lb.; landing weight is 129,000 lb. Wing area is 2,075 ft., wing span 142 ft., and fuselage length, 124 ft. Fuel capacity is 10,220 U. S. gal. Present Northeast plans call for the use of kerosene. The plane has a range of 5,800 mi.

The airline said it will cruise the aircraft at 400 mph. and quoted a scheduled flight time of three hours, 15 minutes between New York and Miami. Eastern Air Lines is presently scheduling its nonstop Golden Falcon flights using DC-7Bs and 1049Gs at three hours, 30 minutes. National Airlines shows a similar flight time for its DC-7 flights.

Bristol and Northeast also are discussing plans to establish a spares depot at either New York or Boston to support the aircraft. Parts will be held in bond by Bristol to prevent Northeast from having to pay duty on any spares except those which are drawn for use.

Bristol maintains a flight and ground crew training school that will be made available to Northeast—at no cost.

Charles Butler, of Butler Associates, who designed the interior of Capital Airlines' Viscounts, is now in England discussing design proposals for the Britannia. A. A. Lane, Northeast vice president of operations and Chief Engineer Edward Splaine also are in England working with Bristol on design details, including cockpit arrangement.

Capital Airlines gave strong consideration to the Britannia 300 series early last spring (AW Mar. 28, p. 46) but later decided on the de Havilland Comet as more suitable to its medium range needs. Capital has ordered 14 Comet 4 turbojet transports at a cost of $53 million. The first Comet is scheduled for delivery in November 1958.

Northeast's present fleet consists of one DC-4, 12 DC-3s, six Convair 240s and one modified C-46. The airline began service between New York and Washington Nov. 27, effective date of route decision announced by the Civil Aeronautics Board last August.

Northeast will expand its services to include Florida upon delivery of the DC-6Bs. No tentative inaugural date of the Washington-Miami portion of the route has been set.

CAB Delays Vision, Panel Rules

Washington—Decisions on the controversial issues of cockpit vision and instrument arrangement were postponed by the Bureau of Safety Regulation of the Civil Aeronautics Board when it proposed its annual amendments to the airworthiness regulations.

The amendments proposed by the bureau stem from discussions held in Washington last September. Draft Release 56-20, the key factor in the discussions, is being handled separately, and the CAB is still awaiting industry comment on the proposed turbine rules in 56-20.

The bureau said it feels that more experience in applying latest industry specifications on cockpit vision is necessary before detailed specifications can be written into the regulations.

The Civil Aeronautics Administration expects to publish manual material soon which describes detailed specifications for cockpit vision, and the bureau

will follow the development of this material to see whether specific regulatory action is needed.

The Bureau of Safety Regulation recognized that the discussions held in September indicated there may be need for a change in the current instrument panel arrangement. Also, proposals for panel changes apparently have created enough uncertainty among airlines to make them postpone plans for converting their present panels to conform with current regulations.

These two factors prompted the bureau to launch a separate study of the problem in hopes of finding a quick solution. The bureau wants to have a solution in time to have any new panel arrangement included in the design of currently planned turbine transports.

To promote early resolution of the instrument panel question, the bureau has set a Dec. 31 deadline on its study. The deadline is designed to permit the CAB to take any needed regulatory action by February.

As a result of the September Airworthiness Review, the bureau has proposed several changes in the Civil Air Regulations. A major revision would designate as fire zones the combustor, turbine and tail pipe sections of turbine engines instead of current rules which designate only the compressor and accessory sections of turbine engines as fire zones.

Other proposals would order safeguards to be taken against failure of turbine rotors and would require turbine engine rotor cases to be designed to contain damage from rotor blade failure.

For non-transport aircraft, the bureau proposed a set of rules designed to cover pressurized cabins from the standpoint of design basic loads, fatigue evaluation and testing. Current regulations do not cover the effect of pressurization on the structure of aircraft which are covered by CAR Part 3. In view of the trend to develop small pressurized aircraft, the bureau has proposed a set of pressurization rules similar to those applied to transport aircraft.

Revised fire protection provisions were proposed for small aircraft to improve their powerplant fire record. These rule changes include a requirement that flexible connections in fuel lines that are subject to internal pressure and axial loading be made by flexible hose assemblies rather than hose clamp connections which are subject to loosening.

Another proposal for non-transport aircraft would require shut-off means for all lines carrying flammable fluids into the engine compartment on all aircraft and would require that lines and fittings carrying flammable fluids or gases in the engine compartment be fire resistant in all aircraft.

New Certification Rules Proposed For Piston-Turboprop Conversion

Washington—New rules have been proposed by the Civil Aeronautics Board's Bureau of Safety Regulation to handle certification of any aircraft the airlines should decide to convert from piston engine to turboprop power.

The Bureau has proposed a set of rules that would permit a change from piston engines to turbine engines under certain conditions without requiring the modified aircraft to meet all of the current requirements for a new type certificate.

If the CAB adopts regulation, it will ease certification of new transports produced through turboprop conversions. Several U. S. and foreign airlines are considering such an engine switch to modernize their Convair transports.

D. Napier & Sons, Ltd., of England, has asked the Civil Aeronautics Administration to approve its conversion of the Convair 340 to use the Napier Eland turboprop engine.

How Rules Now Stand

Convair is discussing the prospects of using either the Eland or the Allison T56 turboprop engine on its Convair liner series transports with several carriers.

Under present rules, a company making a major change in a transport which has a type certificate must apply for a new type certificate for the modified airplane.

For instance, conversion of the Convair 340, which is certificated to turboprop power would require a new type certificate for the whole aircraft.

In such a case, the modified transport would have to comply with all the new transport category regulations approved since the original certificate was applied for.

Under the bureau's proposal, the modified aircraft would have only to meet new regulations which apply to the powerplant so long as the turboprop version has the same number of engines with which it was type certificated as a piston transport.

Powerplant Standards

The new regulation would require compliance with current regulations relating to powerplant installation, airplane performance, cockpit standardization and such other requirements as the CAA might decide is necessary to assure an equivalent level of safety.

The powerplants would have to meet current standards, plus any amendments adopted as a result of the 1956 Airworthiness Review. Performance standards would be based on the results of current discussion of Draft Release 56-20. This document proposes performance standards for turbine transports of current design.

Since a change in engines requires extensive changes in cockpit instruments and controls, the Bureau of Safety Regulation feels that compliance with current cockpit standardization requirements would not be an undue burden.

If other changes are made in an aircraft in addition to the engine conversion, the aircraft would have to meet all the latest regulations related to such changes.

To assure an equal level of safety for all conversions, the proposed rules would be made retroactive and would include all turboprop conversion projects.

The bureau suggested that the proposed Special Civil Air Regulations terminate after five years, and that its substantive effect be incorporated with Part 4B of the Civil Air Regulations in the light of experience gained during the period.

Canada Licenses TAG To Serve Resorts

Ottawa—Taxi Air Group, Inc., Toledo, Ohio, has received an international non-scheduled charter commercial air service license from the Canadian Air Transport Board, Ottawa.

TAG, Inc. will be able to transport persons or goods from bases at Cleveland, Ohio, and Detroit, Mich., to points in the provinces of Ontario and Quebec. Places mentioned primarily in the license are in the hunting and fishing resort region principally reached by aircraft and also in lumbering and mining regions of these two provinces.

TAG, Inc. is licensed to use aircraft having disposable loads of 1,100-6,000 lb.

The airline uses Canadian-built de Havilland Beaver and Otter single-engined aircraft designed for the bush operations for which it is now licensed in Canada.

SHORTLINES

► Collins Radio Co. has received orders totaling $10 million for more than 900 airborne proximity indicator systems and spares.

► Continental Air Lines carried 67,336

passengers in October an increase of 15% over passenger traffic for previous October 1955

▶**Japan Air Lines** reports a net profit of $1,214,000 for the first half of its current fiscal year. While costs increased 12%, JAL's income was up 43% in the April-September period.

▶**Miami International Airport** handled 2,761,784 passengers during the first nine months of the year for an increase of 411,857 over the same period of 1955. Traffic included 695,609 international passengers and 2,066,175 domestic passengers.

▶**National Airlines** will open a new flight operations base in New York this week. The base will be staffed with 40 to 50 pilots and six to eight aircraft on a permanent basis. National has started nonstop Convair service between Washington and Orlando, Fla. The carrier also plans to inaugurate nonstop coach service between Baltimore and Miami on Dec. 14.

▶**Pan American World Airways** opened a ticket office in Atlanta on Dec. 3 to handle increased traffic from the Georgia area.

▶**Resort Airlines** has received a $1,191,132 contract with the Military Air Transport Service to fit jet engines and air frames to Japan. The contract becomes effective Jan. 1 and covers the first six months of 1957.

▶**Scandinavian Airlines System** carried 18,600 passengers over its Los Angeles-Copenhagen polar route during its first two years of operation. In the second year passenger traffic increased 124% and cargo traffic by 93% over the first year level.

▶**Trans Australia Airlines** has sold three of its Convair 240s during the past year, and the airline is looking for buyers for its last two 240s in an effort to standardize its fleet on Viscount and Fokker F-27 equipment.

▶**Trans Texas Airways** flew 417,065 lb. of cargo in October, a 33.8% increase over cargo traffic for the previous October. Air freight increased 45.1%, air mail increased 39.6% and air express gained 25.8% between October 1955 and October 1956.

▶**Trans World Airlines** began service to Tucson on Dec. 1 with four flights a day. The new service will link Tucson with Phoenix and Los Angeles in the West and Chicago, Detroit and New York in the East.

AIRLINE OBSERVER

▶Airlines will hesitate to enter agreements involving the sale of airline tickets by surface transport companies as a result of travel agents' bitter attack on United Air Lines for its contract with Southern Pacific Railroad. The arrangement provides for the sale of tickets and handling of airline reservations by the railroad's ticket offices (AW Oct. 1, p. 43). Travel agents are vigorously protesting the arrangement as unnecessary competition. Some airlines contest the legality of the United contract, claiming it conflicts with the Air Traffic Conference's agency resolutions.

▶**Trans World Airlines will install tubeless tires on its 25 Lockheed 1649s. The lightweight tires will increase the aircraft's payload by 50 lb. and will cost no more than conventional tires. The wheels, however, must be specially impregnated to prevent air leakage through magnesium wheel surfaces.**

▶Douglas DC-9 activities are presently confined to market surveys to determine the sales potential of the medium-range jet transport. Design has reached the final stages, but no engineering work is being done on the project. Trans-Canada Air Lines is interested in a medium-range jet and favors the DC-9 because it will permit some standardization with the DC-8s it already has on order. However, TCA will make no move until manufacturers announce production plans.

▶**Civil Aeronautics Administration has graduated 230 air traffic control trainees from its Oklahoma City training center. The class, largest in CAA history, is the first group to be indoctrinated under the expanded airways program which calls for 1,400 additional controllers by 1957.**

▶Italian helicopter airline to be known as ELI Italian Airlines has been organized at the invitation of the Italian Ministry of Defense and Aviation by Linee Aeree Italiane, Aerolinee Italiane Internazionali and Fiat S. P. A.

▶**Port of New York Authority is negotiating with the airlines for fueling system to service decentralized airlines terminal buildings now under construction at Idlewild Airport. Storage capacity of tank farm will be increased, and fuel will be piped to a satellite tank near terminal. Underground pipeline will fan out from the secondary tank to the unit terminal of each airline. Port Authority probably will handle installation of the system, although each airline will designate the type of fuel facility it requires.**

▶Aviation Facilities Planning Group forecasts 1,000 landings and takeoffs each hour for the New York area by 1975 as compared with an estimated 345 aircraft movements per hour in the area today. The group, headed by presidential assistant Edward Curtis, is conducting an air traffic survey and recently recruited 2,000 persons to spotcheck general aviation flying at 900 different airports over a two-day period.

▶**Allison Division of General Motors Corp., missing no opportunity to promote the Lockheed Electra, recently reported that a Lockheed C-130 powered by four Allison T56 engines passed a Vickers Viscount "handily" while climbing at 2,000 ft. per minute. The T56 will also power the Electra.**

▶Japanese government is interested in building the Convair 440 under license in Japan. Japanese are exploring purchase of Model 440 production tooling from Convair after the San Diego plant completes its production run. Japanese propose to sell their 440s to countries to which they owe war reparations.

▶**Air Transport Assn. will launch an extensive education program, the first in its history, in hopes of placing greater emphasis upon aviation in elementary school, high school and college curricula. "Air age education" committee composed of six leading educators has been organized to prepare an over-all program. First step will be to explore methods now used by other industries and agencies.**

▶Frederic B. Butler has resigned his $1,400-a-month job as manager of the San Francisco International Airport, effective Feb. 15. The Public Utilities Commission has not yet named a successor.

FIRST de Havilland 4 and 4A Comets coming down Chester line are conversions of Comet 1As and 2s. New 4s and 4As follow.

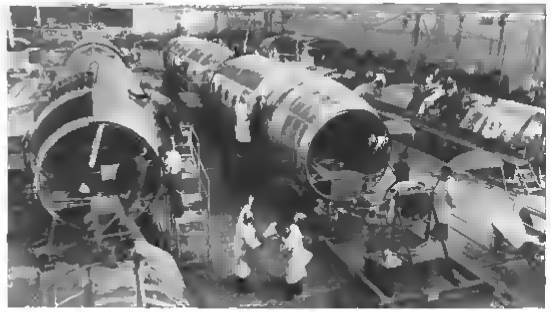
SPAR web sections are milled from a single billet

FUSELAGE bulkhead of new Comet 4 is assembled in horizontal jig.

COMET 1A is converted for the Royal Canadian Air Force.

FUSELAGE is assembled at Portsmouth.

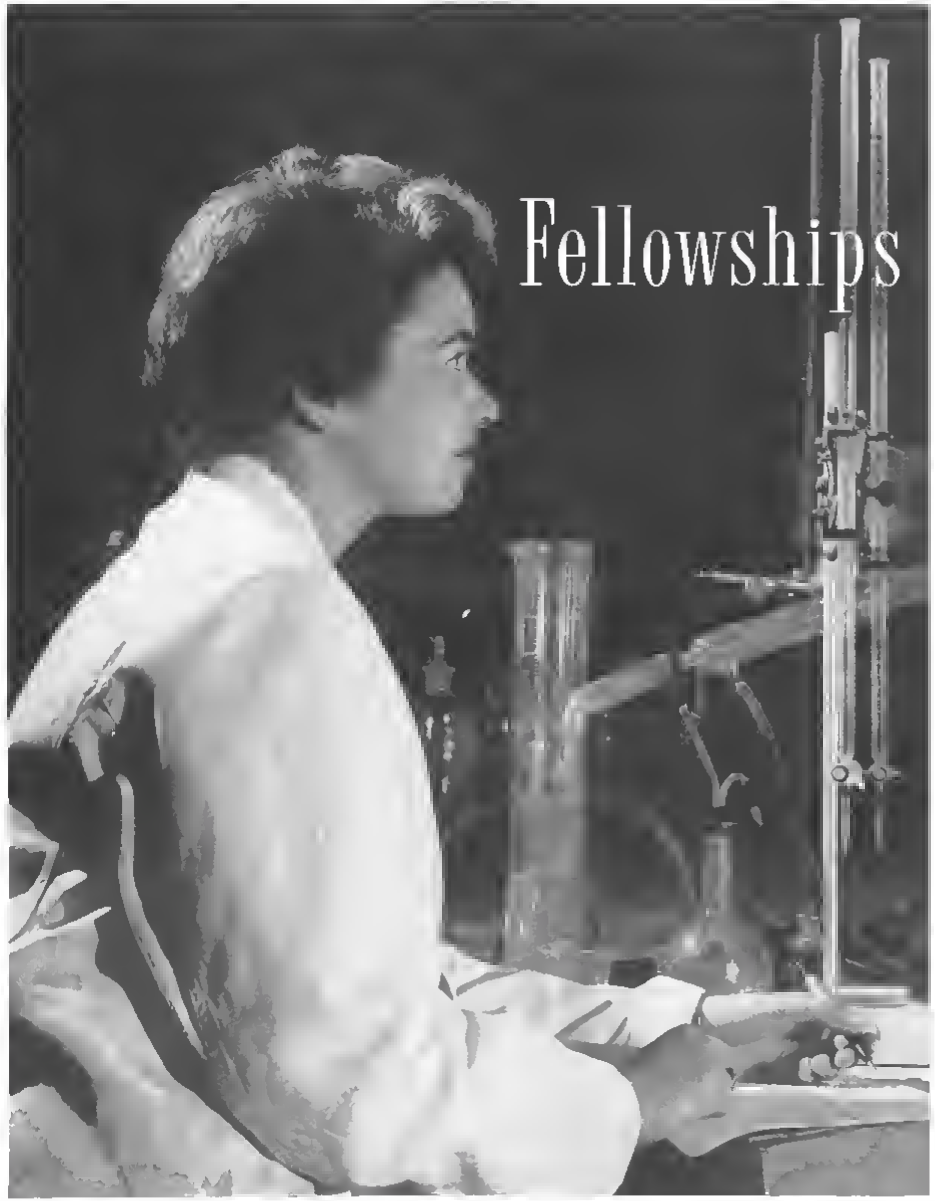
Comet 4s, 4As Start Down Assembly Lines



DOUBLER is installed around hatch in Comet 4 fuselage.

FORGINGS of upper part of main landing gear legs are inspected

LANDING gear leg forgings are machined at Lostock plant.



are the formula for international friendships

There's much more about an exchange of students between countries than textbooks and classrooms. Almost from the moment they set foot in any foreign land they assume the role of unofficial ambassadors. It's no secret that meeting people face to face on a common ground helps remove the barriers between nations. And this is clearly demonstrated in the world of higher education.

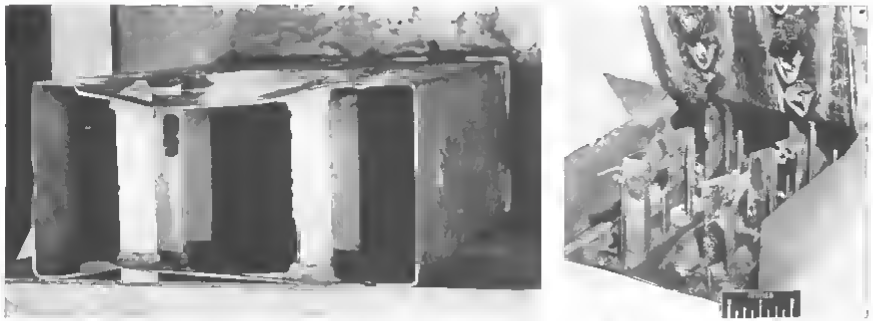
This fall thirty-two graduate students from 14 Latin American countries entered colleges and universities in the United States under fellowship grants sponsored by the U.S. State Department and provided by Pan American. The free round-trip transportation is authorized by the Civil Aeronautics Board and is supplied by Pan Am for students selected by the Institute of International Education.

Pan American's fellowship program started in 1937, and since then 281 Latin American students have studied at 82 colleges in 36 states and the District of Columbia. After a minimum of a year's graduate work, students have returned to positions in the public health service, agriculture departments, schools and other important work.

The purpose of Pan Am's Educational Service Department is to promote cultural relationships and friendship throughout the Americas and the rest of the world. And in addition to fellowships, Pan Am is happy to furnish free transportation to students flying to the *New York Herald Tribune* and *New York Daily Mirror* forums. Pan American sends periodically, on request, to teachers all over the world, the *World Airways Teacher* presenting teaching materials for aviation education, including study units, on the countries of the world. It also provides airport educational tours and flights for teachers as part of the air industry's program of air age education.

The first responsibility of an airline is to be a *useful* citizen.

PAN AMERICAN WORLD AIRWAYS
WORLD'S MOST EXPERIENCED AIRLINE



SILICONIZED powder metallurgy molybdenum prisms in ramjet flameholder (left) were only slightly oxidized in spots where coating failed after 47 min. operation. Single molybdenum prism (right) remains intact where Inconel gutters melted.

Molybdenum Offers Over-1,600F Uses

By Russell Hawkes

New York—Molybdenum alloys may be top contenders for structural use in the temperature range above 1,600F. This was indicated in a report to the American Rocket Society and the American Society of Mechanical Engineers by Robert R. Freeman and Janet Z. Briggs of Climax Molybdenum Co.

Graphite was discussed in another report as a structural material for use in high temperature gas streams. Reports on rocket engine design problems included an analysis of steady state burning of composite solid propellants discussion of thrust control for liquid propellant rockets and a progress report on an improvement in tail pipe design.

Four commercially available alloys all have better high temperature properties than unalloyed molybdenum. Titanium-molybdenum has shown the best all round performance to date.

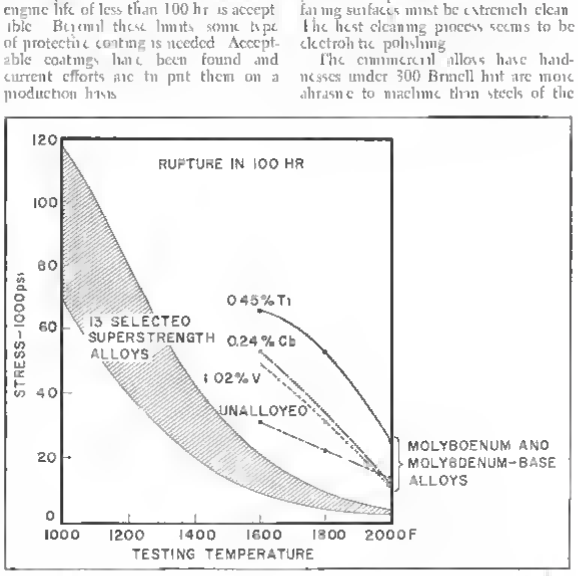
The alloys retain high melting point, high thermal conductivity, high values for modulus of elasticity low coefficient of expansion and good resistance to thermal shock. Stress rupture points and creep strength of the commercial alloys are better than those of unalloyed molybdenum.

Like unalloyed molybdenum present alloys cannot be heat treated. Recrystallized specimens have 40% to 50% lower rupture strength at 1,600F than warm worked and stress relieved specimens of the same grade. This loss becomes smaller as operating temperatures are raised and disappears if temperature and time are such that the metal recrystallizes in service.

Disadvantage of molybdenum and its alloys at high temperatures is their rapid rates of oxidation when hotter than 1,000F. Alloys with acceptable oxidation rates have been found but they have been too hard to be workable. In some oxygen deficient combustion gases, unprotected molybdenum can be used in temperatures up to 2,600F where engine life of less than 100 hr. is acceptable. Beyond these limits some type of protective coating is needed. Acceptable coatings have been found and current efforts are to put them on a production basis.

Molybdenum alloys can be fabricated by most conventional methods but not all joining problems have been solved. For some applications, welds with adequate ductility can be made. To prevent embrittlement of the weld all air must be excluded from the weld puddle and preheated surfaces and the faying surfaces must be extremely clean. The best cleaning process seems to be electrolytic polishing.

The commercial alloys have hardnesses under 300 Brinell but are more abrasive to machine than steels of the same hardness. Sheet stock can be formed at room temperature in thicknesses below 0.020 in. but heavier stock must be heated to between 200F and 1,100F depending on thickness.



HOW molybdenum and three molybdenum base alloys ranked in stress-rupture comparison.

Graphite for Heat

Leon Green, Jr. of Aerojet-General told ARS members that because of its high thermal conductivity, high strength when hot, low expansivity, and low relatively constant elastic modulus, graphite provides good resistance to thermal shock.

This combined with the fact that its strength increases with temperature rise to about 4,500F has suggested that graphite might be used for structures exposed to flow of hot gases. Uses have been limited because it oxidizes in air at temperatures above 500C. Also it is attacked by strongly reducing atmospheres such as hydrogen at temperatures in the best part of its temperature strength curve. Because of this it must either be coated or used in an inert atmosphere.

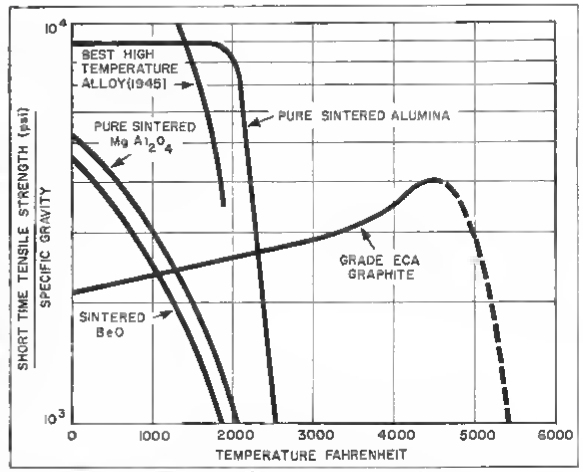
It is a good neutron moderator and has long been considered as the core material in a high temperature nuclear power reactor cooled by a stream of inert gas. Helium has been suggested as the coolant because of its chemical inertness, small neutron absorption cross section and heat transfer properties which are relatively good for a gas. Concern over the possibility of erosion of the graphite by the helium stream at high temperatures have been allayed by the results of a study in which erosion of graphite at 2,000C by a high velocity stream of hot helium was limited to the loosely held particles smeared into the surface by machining.

Graphite might also be used to protect airframe surfaces from aerodynamic heating. Because of its porous structure it could conceivably be penetrated by helium in a transpirational cooling system. By cooling the graphite and surrounding it with an inert atmosphere the designer could take advantage of the good mechanical strength of graphite at high temperatures.

The burning mechanism of composite solid propellants has been analyzed by Martin Summerfield and George S. Sutherland of Princeton University to provide a basis for prediction and control of steady state burning rates. Using ammonium perchlorate in a cellulose base binder it was found that the main reaction zone is mostly or entirely in the gas phase and is less than 0.1 mm. thick. The zone becomes thinner as pressure rises. At high pressure small scale turbulence causes uneven burning which scallops the surface of the propellant.

Burning is controlled by the rate of reaction in a granular diffusion flame zone. Granular diffusion is produced by the tendency of the binder to evaporate below the combustion temperature of the fuel grain.

Because of this the burning fuel particles protrude into the chamber giving a third dimension to the reaction zone and at the same time producing small regions of diffusional mixing. Reaction rate is dependent on pressure, mixture ratio of fuel to binder, and fineness of the fuel grind.



STRENGTH-to-weight ratio of metals includes curve for graphite.

Thrust Control

Development of big liquid propellant rockets is creating a demand for a means to program thrust, acceleration and cut-off velocity and to compensate for changing atmosphere back pressure and altered engine characteristics. The demand was explained by Rudolf H. Reichel of Bell Aircraft.

Constant thrust gives the best rocket performance only in a drag-free flight path where it is best to exhaust propellants as rapidly as possible to avoid the work of lifting their mass. This condition can only be assumed for the upper stages of a multi-stage high altitude rocket. In aerodynamic drag regions thrust must be programmed to get the highest possible cut-off speed. By controlled programming of thrust payload can be increased significantly over that of a constant thrust rocket of equal performance.

Piloted rocket aircraft provide an outstanding instance of need for thrust control. To get best range and flight duration a small long time sustaining thrust at altitude is desirable. At the same time the most economical speed should be as high as possible because propulsive efficiency is a function of flight speed. At low altitudes, drag limits economical speed and propellants should not be expended unnecessarily to overcome a sharply rising drag curve. As the human pilot's freedom of choice permits a change in flight plan he should be capable of programming his thrust to meet new circumstances.

Approaches to thrust control are:

- **Fixed expansion nozzle** and variable flow rate.
- Variable area expansion nozzle.

For a fixed sea level nozzle, underexpansion occurs for all full throttle operations at high altitude. When the nozzle is designed for an optimum altitude overexpansion occurs at lower altitudes. Both reduce performance. Throttling limit is determined by shock criteria when exit pressure becomes less than 0.4 of design atmospheric pressure. As a result controllability is restricted at low thrust levels and low altitudes.

The variable flow rate fixed nozzle control has limited application because lowered injection differential pressure decreases system stability even if mixture ratio remains constant. Also any deviation from design conditions means increased specific propellant consumption. With regeneratively cooled chambers it is at a disadvantage because heat removal capacity is reduced more than heat input. One way of avoiding changes in injection differential pressure is to use different injector heads with two combustion chambers.

Varying throat area will keep chamber pressure constant. For full thrust the throat plug is withdrawn to give

PUMP PRIMERS

GEROTOR aircraft pumps offer extremely compact, flexible design

Few pump designs offer such extraordinary flexibility in accommodating themselves to the structures in which they are housed or mounted as does the Gerotor type.

The Gerotor is a form of internal gear pump consisting of only two moving parts: an inner toothed element and an outer, meshing toothed element. The inner element has one less tooth than the outer and the "missing tooth" provides a chamber to move the fluid from the inlet port to the outlet. (See Figure 1) Pump capacity is measured by the volume of the "missing tooth" multiplied by the number of driver teeth and RPM.

FIG 1

▶ **The designer** thus has the advantage of several variables to secure a given capacity within his space limitations. *Gerotor diameter* – which governs the area of the pumping chamber—*Gerotor thickness* which, taken with area, determines chamber volume – *Gerotor RPM*, since this is a positive displacement pump. Thus, it is possible to vary the diameter, the length and the speed of the pump within certain overall limits to secure the wanted capacity.

▶ **Unlike conventional** gear pumps the Gerotor needs only a *single shaft* – both elements are substantially concentric to it. These are mated to provide continuous, fluid-tight engagement without the crescent structure necessary in other internal gear pumps. Further, Gerotor elements can be stacked along a single shaft and mounted on a single AN pad to perform multiple pump functions—lube, scavenge, boost, etc. (See Figure 2). Such compactness allows the pump to be "submerged" in a gear box or sump and frequently the sump may be part of the pump housing.

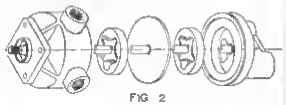


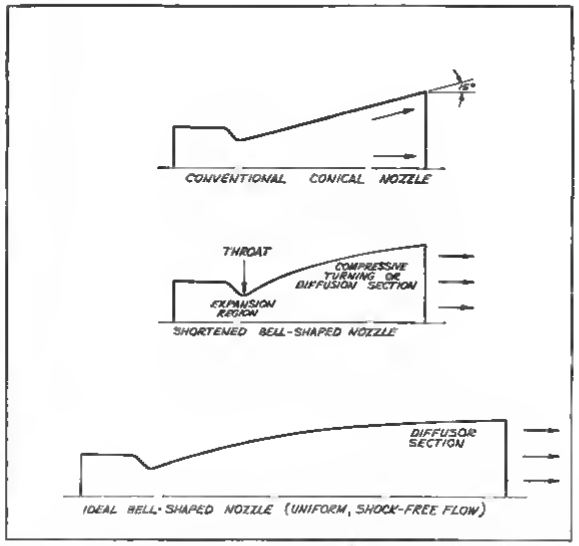
FIG 2

▶ **Gerotor pumps** are lightweight, valveless, provide high volumetric and mechanical efficiency and offer exceptional performance at high altitudes.

▶ ***Technical Data*** *– is available and your inquiry is invited. Write!*

W. H. NICHOLS CO.

48 Ward Avenue Waltham 54 Massachusetts



DRAWING compares shortened bell-shaped nozzle with ideal and with conical nozzle

maximum nozzle area and it can be throttled to keep chamber pressure up as mass flow decreases.

Most supersonic nozzles have had conical expansion sections. Demand for increased performance has created a trend toward higher exhaust area ratio nozzles for operation at high altitudes where the large nozzle is most effective.

Higher exhaust area ratios increase length, exit diameter, weight and stresses in the nozzle. Therefore, it is desirable to shorten the nozzles of high performance rockets. This can be done by increasing the divergence angle of a conical nozzle but the result is a loss due to lateral flow of the reaction mass.

A supersonic nozzle which produces completely axial exit flow will have an expansion section from the throat followed by a flow straightening section. The result is a bell shape.

For years ideal nozzles of this shape have been used in wind tunnels, but for the same area ratios this has produced nozzles that are twice as long as those of current rocket engines.

Robert B. Dillaway, Rocketdyne Division, North American Aviation, Inc., reports progress on a design which is a shortened version of the bell nozzle. This must turn flow at a given Mach number without producing compressive disturbances. Evidence indicates that straightening can be distributed along the nozzle wall so that shock wedge angles are limited to one or two degrees and flow will still behave as if it were isentropic. In such nozzles flow velocity distribution varies from axis to wall but remains essentially axial. Peak velocity shifts from the flow axis to an annular ring position in the exit flow plane.

Investigating the fundamental behavior of a combustion system involving a non-oxygen oxidizer, M. H. Bortner and P. E. Friebertshauser of Rocketdyne told the Rocket Society that since the flame speed was one-tenth that of an oxygen oxidized system, the design of a non-oxygen oxidizer system would demand higher operating temperatures, higher pressures, and possibly the addition of a catalyst to speed up the process artificially.

For the fuming nitric acid-hydrocarbon system they analyzed with a bunsen burner apparatus, the two Rocketdyne engineers predicted that actual combustion systems built around these substances would be more difficult to operate and would require closer control of operating conditions than oxygen oxidizer systems. They would require increased combustion volume with better stirring to keep all of the combustion mixture at higher temperatures as long as possible.

They must be designed to minimize the danger of the explosive products of combustion such as nitroalcohols and nitropolymers from forming deposits which might disrupt the combustion process.

Air Force Jet Overhaul Experience Will Guide Planning By Airlines

By Irving Stone

Tinker AFB, Okla.—Airline engineering representatives planning for the maintenance of jet engines in the new transports were given first-hand information here on Air Force cost and operational experience with testing after overhaul.

Highlights of this powerplant readying phase, a key operation in airline jet maintenance activities, were outlined by Robert Sherwood of the Oklahoma City Air Materiel Area at the symposium sponsored by the Air Force for the Air Transport Assn (AW Oct 29, p 32). Sherwood generally referred to the P&W J57 engine, which OCAMA is processing at its overhaul base and which will be used in some models of the Douglas DC-8 and the Boeing 707.

Overhaul Time

Approximately 20 manhours are required to process a J57 non-afterburner engine from the end of the overhaul line through the test cell. This time includes dressing of the engine with slave equipment, installation in test cell, prestarting, functional check, acceptance schedule, removal from cell, stripping of slave test equipment, covering all openings and routing the engine to the canning area.

Cost of the overhaul test for the J57 non-afterburner model, based on a labor charge of $2.03 per hour and materials used, comes to about $200. It includes these items: dressing labor, $6.71, labor for installing, testing and removing the engine, $30.11, stripping labor, $4.79, fuel used (approximately 1,200 gal.), $134.40, lube oil (about 3 gal.), $24.75.

An engine removed from test because of mechanical difficulties or failure to meet performance specifications is rejected. When the General Electric J47 was introduced into the Air Force overhaul program, rejection rate through the training phase was about 40-45%. Now, after many thousand J47 overhauls, the rate fluctuates between 10-15%.

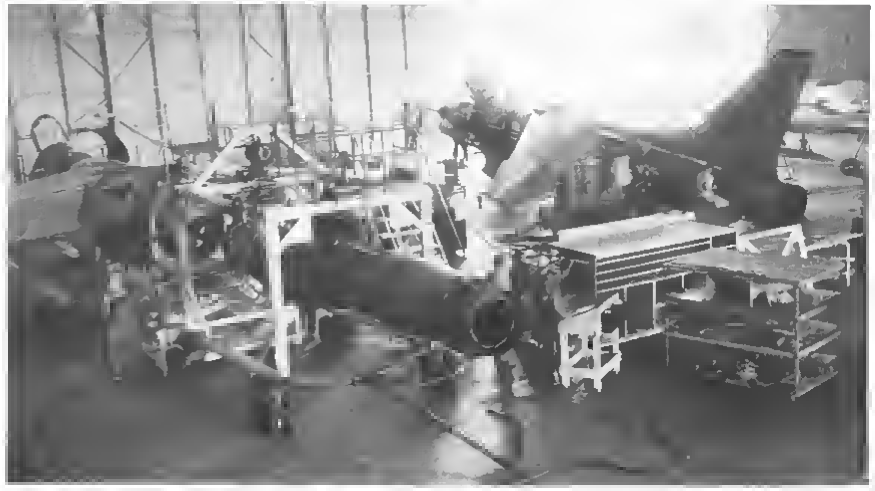
The J57 engine, newer, more complex, and requiring rework procedures and techniques very different from other engines, has a rejection rate of approximately 40%, Sherwood said. The figure a year ago was much higher. Major factors causing J57 rejection in test after overhaul are oil leaks (14%), vibration (13%), fuel system components (4%), and miscellaneous causes (9%). Many of the defects which contributed to the reject rate could have been repaired in the test cell, Sherwood admitted.

Discussing the most frequently occurring problems in test after overhaul, Sherwood tagged vibration as one of the biggest headaches. Vibration equipment used by the Air Force is designed for measuring the high frequencies and discriminating against the lower frequencies, which are not detrimental to engine life. Function of the equipment is to check vibration caused by unbalance of rotating parts. Magnitude of the lower frequency vibration is several times that of unbalance and if rotational frequencies are to be measured, it is necessary to discriminate against the lower frequencies with filters in the meter circuitry.

Vibration Fixes

Sherwood said that many procedures have been applied to a vibrating engine, such as rotating turbine wheels 180 deg. and re-indexing them a 90-deg. turn, etc." This has cured some engines he said, but the majority end up at the rework line for rotor rebalance and bearing checks.

Another test problem is internal engine noise. Sources of this noise include compressor and turbine main



CHANCE VOUGHT AIRCRAFT'S F8U Crusader in maintenance hangar shows access to the Pratt & Whitney J57 afterburning engine version. By 1958, when it goes into airline service, J57 will have accumulated 4½ million operational hours.

bearings, accessory gear train, air-oil seals, lube or scavenge pumps, distorted exhaust cone, distorted shroud ring or segments. Quality of the noise should be resolved by the most experienced man available. With the engine operating at idle speed, he stands close to the side of the engine inlet. If abnormal sounds are detected it may be necessary to lay a hand on the forward frame to assist in determining the noise frequency.

The engine is shut down for listening to coastdown. If noise is not heard during the entire coastdown the engine is considered serviceable. If a definite noise is heard during the coast down, it is analyzed for frequency and location.

Shutdown Fire

Engine shutdown fire, another test problem, is usually caused by a leaking stopcock, drip valve malfunction, internal oil leak, and improper procedure used in the shutdown cycle. The exhaust gas temperature indicator is commonly used to detect shutdown fire. During a normal shutdown, the indicator will drop to 200-250F and remain within a 100 deg. of this value. If there is a fire the reading will rise to 450-500F, perhaps higher, after the engine stops rotating.

Normally such fires are put out by closing the fuel valve and throttle and motoring the engine with the starter to blow out the blaze. If the fire indicates immediate danger, carbon dioxide is released into the engine.

Starting precautions also were detailed by Sherwood. The operator motors the engine without fuel or ignition on to clear the combustion section of fuel and oil to prevent a hot start. On twin-spool turbojets an additional test inspection precaution is to make sure that the low speed compressor turns in sympathy with the high speed compressor when the engine is motored with the starter. In cold weather, if the overhaul assembly line has not properly controlled the turbine blade seal clearance, a rub condition could exist which might prevent the low speed unit from turning. Thus, the engine would not get a sufficient supply of air for the fuel scheduled, and a hot or hung start could result.

Test Cells

Outlining overhaul test cell features Sherwood said that because of the different engine models the Air Force runs in each cell (a condition the airlines will reach as different engines are used), the most recent design incorporates a removable electrical panel and cable for each model. Only the system common to all engines is built into the test cell.

Thus, with relatively minor modifications, all Air Force test cells are universal up to the maximum thrust capacity established for each cell.

Each USAF depot is equipped with two groups of cells, one for jets up to 30,000 lb. thrust, and others for jets up to 15,000 lb. The latter group are converted from reciprocating engine cells.

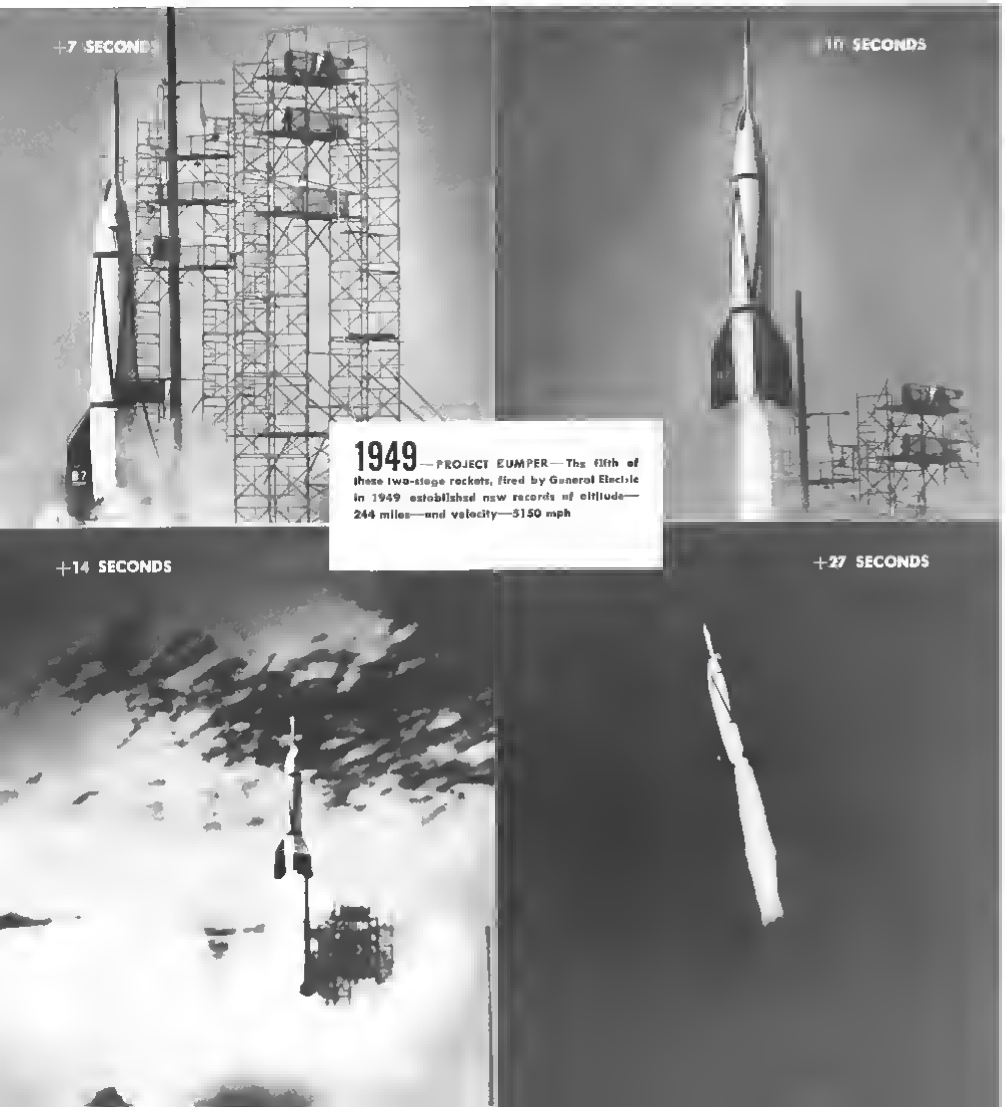
Cost of constructing and equipping the eight-cell facility at OCAMA including a new aqua type fuel storage and supplying system was about $4 million.

Noise control is the most expensive single factor in the cell, Sherwood said, but despite cost, is considered second in importance to cell performance. The Air Force keeps tight control over the design, then makes sound treatment fit the desired configuration. All of the Air overhaul test facilities are located in populated areas, both industrial and residential.

"In the latest Air Force cells it was determined that sleeping criteria at 2,000 ft. would suffice, and this has been proven satisfactory to date," Sherwood declared. For control rooms the Air Force aims at a speech interference level of 55 db.

Methods of sound treatment are conventional. A combination of various acoustical devices are used, such as

How General Electric Experience Advances Missile Technology



1949—PROJECT BUMPER—The fifth of these two-stage rockets, fired by General Electric in 1949 established new records of altitude—244 miles—and velocity—5150 mph

General Electric's Project Bumper established new records of altitude and velocity. But far more important is the valuable research data compiled in the successful completion of the Bumper project. Many problems were overcome with Bumper—problems in temperature, telemetry, separation, and aerodynamics. Bumper helped solve the problems of communicating with missiles at extreme altitudes, and was a major preliminary step in the development of a satellite. In solving these and other problems, General Electric has contributed a wealth of research data to the missile industry—information that is being utilized on the nation's top priority ballistic missile project.

General Electric's Missile & Ordnance Systems Department presently is working on an Air Force prime contract to develop the ICBM nose cone. Programs are being carried out in such varied fields as communications, hypersonics, metallurgy, mathematics, and thermodynamics to support this nose cone contact.

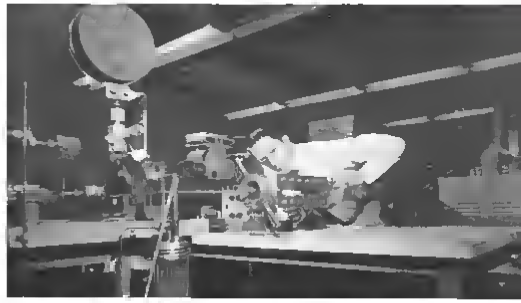
General Electric has formed the Missile & Ordnance Systems Department to act as a Company focal point for large, highly complex missile projects. Scientists in the new department, backed up by the vast resources of many General Electric operating departments and laboratories, are currently working to solve the perplexing problems associated with the ICBM nose cone and other missile projects.

By focusing this wide range of specialized talents of General Electric personnel on highly complex defense system problems, the Missile & Ordnance Systems Department is making significant contributions to America's defense program. Section 224-5, General Electric Co., Schenectady 5, New York.

ENGINEERS: G.E.'s Missile & Ordnance Systems Department is currently expanding its staff of highly skilled engineers and scientists. If you have a background of successful creative engineering, send your qualifications to Mr. George Metcalf, General Manager, Missile & Ordnance Systems Department, General Electric Co., 3198 Chestnut St., Philadelphia, Pa.

TODAY—CONTINUED RESEARCH AND EXPERIMENTATION in advanced missiles and missile systems is helping solve such advanced problems as development of the ICBM nose cone. Headquarters for General Electric's participation in these programs is the Missile & Ordnance Systems Department in Philadelphia, Pa.

MR. ROBERT P. HAVILAND, Flight Test Engineer at MOSD, directed Project Bumper and other advanced programs, gaining valuable experience which he is currently applying to present missile programs.



DR. YUSUF A. YOLER—widely known for research in hypersonics—is currently engaged in the design and development of wind tunnels, shock tunnels, mass accelerators, and other facilities for continued progress in missile systems.

Progress Is Our Most Important Product

GENERAL ELECTRIC

lined ducts, parallel thick baffles and parallel thin baffles

Lower first costs in test cells have been achieved by maximum use of cooling water in lieu of cooling air Size of the intake stack is dictated by the negative pressure allowable in front of the engine, while size of exhaust is determined by the quantity of water available and degree of sound attenuation required Where existing reciprocating engine test cells have been converted it has been found most convenient to have one intake for combined engine air flow and cooling air

Building Materials

Many conventional building materials have been used and are protected from heat by an economical balance between insulation and cooling the jet blast Basic cell structure is reinforced concrete held to 250F Heat-structural problems are minimized by eliminating load-carrying inserts in the concrete in the hot end of the test cell All baffles are suspended on beams carried on top of the stack They are built up on the ground into units for easy pickup and setting in place by crane also permitting easy removal inspection and cleaning This suspension method also has largely solved the thermal expansion problem

Air Force field maintenance activities have or are now receiving field test cells These units are generally of two types—the Shaw Estes cell and the OCAMA run up test stand

The Shaw Estes cell is designed to evaluate power of jets at bases where the full scope of minor repair is performed It is equipped with controls for starting and operating the engine and with instruments for measuring such factors as thrust, vibration, temperature and pressure Cost of construction and equipping the Shaw-Estes single unit test cell is $30,000, and double unit is $45,000 Sherwood says

Run-up Stand

Purpose of the run-up stand is to assist field maintenance personnel in their minor repair function The stand is portable and can be moved and set up again in short time Engines can be trimmed on the stand prior to aircraft installation, eliminating many hours of aircraft down time Many field maintenance repairs of an engine can be cleared "serviceable" with use of the run up stand

Cost of the unit is $8,000 It consists of the stand, control house, equipment cabinet, and electrical systems Instrumentation is provided for checking fuel pressure, oil pressure, tailpipe temperature, and engine rpm Mounting blocks are provided for securing the installation to concrete flat car or trailer, as desired

Injection Cuts 2,000 ft. Off B-47 Takeoff

By Robert Cushman

New York—Two aspects of General Electric's experience with the J47 gas turbine engine which should be helpful to designers of future commercial turbojets are the use of water-alcohol injection to decrease takeoff distance and a study of the effect of heavy rainstorms on the engine operation.

Water-alcohol injection, popular with B-47 users in the service, according to General Electric, may be the answer to commercial transport hot-day, high-altitude field take offs.

General Electric has pumped as much as 1,000 lb. of water and alcohol per second in the J47 combustion chambers, M. K. Wolfson, manager of the J47 project at the Evendale, Ohio, plant, told a recent meeting here of the American Society of Mechanical Engineers.

Mass Flow Increase

Unlike afterburning which increases thrust by raising temperature to increase jet velocity, the water increases the engine mass flow to increase thrust. The 28% alcohol is added to burn and neutralize the cooling effect of the water.

B-47 bombers now operate at 650 lb. per sec. water/alcohol which gives about 22% thrust augmentation and cuts 2,000 ft. off the B-47's ground run.

Water/alcohol injection is the only way to increase overloaded safety on short fields without either cutting down the aircraft's range with the permanent drag of an afterburner or seriously curtailing the pilot's control over takeoff by using JATO units which must be fired after it is too late to turn back. Injection places a slight weight, performance or drag penalty upon the engine and aircraft and can be cut in by the pilot before releasing his brakes as a check on reliability and then cut off by the pilot should he change his mind during the take off ground run.

Developmental steps in perfecting injection cited by Wolfson were:

- **Adding eyelets** in the combustor to direct jets of air into the combustion core to shorten the alcohol combustion flame.
- **Increasing cone angle** of the injection spray nozzle from 90 to 120 deg. to increase dispersion and adding a detergent—both changes to prevent the thermal shock and corrosion effects caused by incompletely vaporized water particles impinging upon the turbine buckets.

A parallel test facility problem to find the right, non-corrosive detergent was installing a deionizing system to prevent the Evendale, Ohio, water supply from loading up the turbine nozzles and buckets with a hard calcium-like deposit. These deposits, after building up, could break away unevenly and leave the unbalanced turbine wheel in high frequency vibrations.

General Electric researchers have also run a study in which they simulated the effects upon a J47 engine which suddenly entered a severe rainstorm.

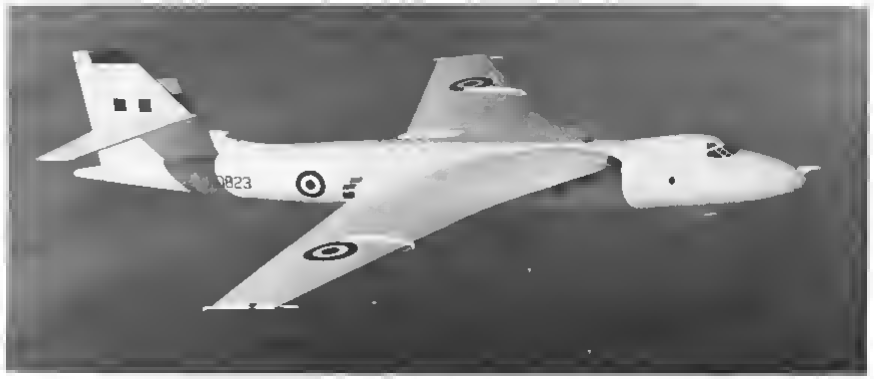
In a test program in which water sprays from 2 to 60 grams per cubic meter or airflow were directed into a J47 inlet, S. S. Wayne, of the Jet Engine Dept., Evendale, said that he found that increasing the percent of water in the inlet airflow up to 3% by weight brought the compressor temperature down 200F. and cut the blade tip clearance of a water stage from .02 to .005 in.

However, further increases in percentage of water did not show any further effects (although it was pointed out that in actual altitude flight more severe "freak" rainstorms could air-starve the engine combustion system.

Rapid Entry Problem

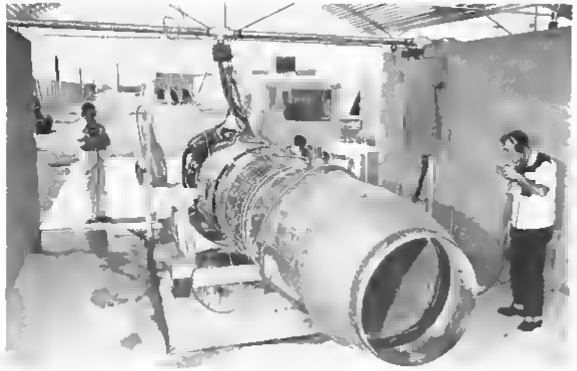
It was found that the fine spray entering the compressor was centrifuged so that it entered the combustors as a solid stream of water, concentrated by gravity at the combustor bottoms. Although this lack of symmetry did add to the blade tip interference problem, the main cause of blade rubbing was from the more rapid contraction rate of the compressor casing as compared to the compressor rotor. This means that the most critical period is in rapidly entering a severe rainstorm, Wayne said.

However General Electric feels that the compressor rotor clearance problem can be met with clearance re-design and that the other effects of severe rain



Anti-Radiation Paint for the Valiant

Vickers Valiant B.1 bomber has special paint job designed to provide some measure of radiation protection from nuclear blast. White gloss paint is new RAF standard for Valiant and other V bombers. Aerial refueling probe is carried on nose and vortex generators between wing fences and tips. Valiant is powered by four 10,000 lb. thrust Rolls-Royce Avon turbojets. It was used in bombings of Egyptian airfields.



Northrop Run-up Stand

Engine technicians at Northrop Aircraft Inc.'s Palmdale, Calif. plant visually observe a run-up operation in new run-up stand while maintaining radio contact with controller in booth in background. Allison J35 engines for T-39 Scorpion are mounted on floating concrete pad surrounded by felt to preclude inaccurate instrument readings because of other vibrations. Stand allows technicians to move completely around engines to observe fuel or air leaks or make adjustments.

is evidenced by this study are not harmful.

They do recommend, though, that pilots reduce engine speed by at least 85% engine rpm. when flying through severe rain.

A "fairly fundamental" discussion of progress in the analytical methods of attacking the secondary flow and boundary layer build-up problems in turbomachinery (particularly axial flow compressors) was presented by R. W. Moore, Jr., of Arthur D. Little Inc., Cambridge, Mass., and D. L. Richardson, United Aircraft Corp., East Hartford, Conn.

The boundary layer build-up near the blade roots of compressor rotors is complicated by the fact that the stator blades upstream are standing still and the rotor blades are attached to a whirling hub. Though the occurrence of this phenomenon has been well known to compressor aerodynamicists, little has yet been accomplished in reducing the complicated picture of this secondary flow to exact mathematical theory and thus gaining some design control.

While working in the Massachusetts Institute of Technology Gas Turbine Laboratory, the authors built a cascade model in which additional sidewise jets supplied the cross flow which would be due to the hub rotation. Although they admitted that the main result of their model runs was simply to verify that the actual three-dimensional flow in the blade root boundary layer is far too complicated to be subjected to two-dimensional simplification, several authorities present at the session stated in the subsequent discussion that this in itself was an important achievement.

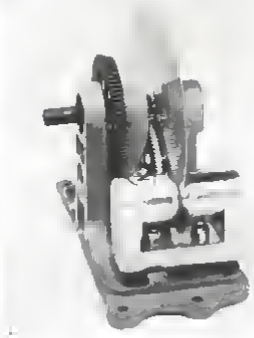
Several comments from the floor indicated that in the future specially designed blades will enable engine manufacturers to take advantage of the peculiarities of this secondary flow in raising the compressor efficiency. Twisted roots or anti-cross flow ribs between the blades were two suggestions.

Damper Promises Better Control

A self-contained eddy current damper that provides a nearly linear relationship of damping rate to input speed promises solution to many of the control oscillation and overload problems occurring in the newer aircraft. It is designed by Lunden Aircraft Corp. of Newark.

Based upon a principle familiar to high school physics students, the unit's damping energy is provided by electromagnetic resistance to the rotation of a copper disk between two fixed magnets. It is proportional to the disk's speed of rotation. A gear train raising the speed of the disk relative to that of the input shaft increases the slope of the damping rate-speed curve proportionally to the square of the gear ratio.

The eddy current damper requires no external power supply and operates



at temperatures between —100F and +300F It offers none of the maintenance headaches associated with hydraulic and friction dampers as there is no fluid to leak and a negligible amount of wear The strength of the Alnico V magnets is persistent enough for Lyndon engineers to predict that gear train wear will be the critical factor in unit life

Damper Tests

The magnets are unaffected by operation cycles or temperature variations up to 1,000F Grumman Aircraft Engineering Corp tested the damper for 202,000 operating cycles and quit because the test mechanism was loosening up

Backlash in the damper opened up from ¼ deg to ½ deg

Grumman has bought the unit for F11F Tiger It will be installed at the base of the control stick to damp out oscillations imparted to the elevators, lower the natural frequency of the elevator control system to prevent it from phasing with the airframe natural frequency and reduce the danger of overcontrolling the highly boosted system at low airspeeds At the high speeds for which boosted systems are designed, the danger of overcontrolling is less because speed control action is limited by high aerodynamic loads As a result less damping force is generated and control feel is more nearly uniform at all speeds

Force Control

An automatic variable rate damper to cope with changing oscillations is being considered Damping force can be controlled by altering the gap between the disk and the magnets It varies inversely with the square of the gap.

Another way to control damping is to replace permanent magnets with variable electro magnets Lyndon en-

gineers oppose this approach as it involves an external power source.

Glenn L. Martin Co. has bought 13 eddy current dampers for use on P6Ms ordered by Navy. They will replace rudder gust locks. The ratio of damping rate to the angular velocity of rudder movement is low enough to be virtually ineffective at normal control velocities but high enough to prevent the rudder from banging against its stops at speeds which would impose damaging load factors.

Grumman is said to be considering a gust lock application of the damper on late dash numbers of the S2F. They favor a clutch arrangement, probably electric to disconnect the unit in flight.

Chance Vought has purchased the unit for control surface damping in flight on the F8U. It is to be installed on ailerons, elevators and rudder.

Douglas has bought evaluation quantities for the F5D and A4D.

Bellanca Aircraft Plant Purchased by Piasecki

New Castle, Del.—Piasecki Aircraft Corp. has purchased the Bellanca Aircraft plant here for $1,325,000. It had been considering the purchase for several weeks (AW Nov. 12, p. 23).

Piasecki announced that the 330-acre property with 158,000 sq. ft. of floor space and equipment in four buildings, will provide a tenfold increase in the firm's manufacturing capability.

The present plant at Philadelphia International Airport also will be expanded. Piasecki said to add another 100,000 sq. ft. to production and administrative areas.

Headquarters for Piasecki Aircraft will remain at Philadelphia. James H. Mamming, retired Navy officer, will be in charge of the new Delaware plant.

The property includes a private airport with a 3,500-ft. runway. It is located on the Delaware River.

Southwest Awarded Navy Engine Contract

Washington — Southwest Airmotive Co., of Dallas has received the first engine overhaul contract to be awarded by the Navy to a non-manufacturing facility since the end of World War II.

The $750,000 contract, providing for the rework of approximately 300 engines, calls for the overhaul and modification of Allison J33-A-16 and J33-A-16A engines to J33-A-24A configuration for use in Lockheed T2V-1 jet trainers.

The company also will overhaul the engines' main fuel controls. First production is scheduled to begin shortly after Jan. 1.

Tape Control Applied to Standard Tools

Downey, Calif.—New tape control system for standard machine tools has been developed by North American Aviation Inc.'s Autonetics Division for economical production of single unit or small quantity parts.

The control system and the Cincinnati Hydrotel to which it has been applied initially will be put into production soon at NAA's Inglewood, Calif., plant.

Details of the tape control system, known as Numill, were revealed by Lionel S. Peck, Autonetics Division application engineer. It was developed specifically to produce templates, profile bars, profile mill fixtures and other two-dimensionally defined parts. In addition to these tool making jobs, the Numill control already is being used to meet some small-lot production requirements. Highlights of the tape control system include:

- Automatic tape preparation.
- Digital feedback to provide wearproof precision.
- Display panel for machine setup instructions.
- Path or point control.

NAA procedures now used for template making require that master contour lines be laid on metal loft boards by skilled loftsmen using previously developed coordinates. These master lines are duplicated on template material by expensive contact printing and the piece is filed to shape as accurately as possible by the template maker.

Saves Time, Money

Application of numerical control to this template making process eliminates all of these steps. Starting with point coordinates, formulas, or other numerical definitions of the template or tool contour, a control tape is produced, using digital computer techniques which make this an inexpensive and neatly automatic procedure, Peck said.

Cost savings achieved by Numill in producing single tools and parts are largely dependent upon inexpensive control tapes, Peck said. NAA's experience with IBM 700 series general purpose digital computers led to the selection of this equipment for tape making. All the information required to produce a template or part of average complexity is contained on about 12 in. of tape. In addition to the IBM equipment, a wide range of general purpose digital computers can be used.

The computer translates basic engineering data into a series of commands required to produce the part. It calculates the path which must be followed by the center of the cutter to generate the specified contours. This path consists of a series of straight line cuts, which approximate any curve to a given tolerance, Peck says. The computer also calculates machine accelerations so that the cutter may negotiate corners or change direction without error, such as overshoot. Calculations are written on the magnetic tape as numbers, in binary code.

Master Program

All calculations are controlled by a master program, which directs each step of the computer's operation and checks all calculations for accuracy. The master program represents a stored technical skill, Peck says, which permits the computer to perform complex calculations under the direction of non-technical personnel.

Applied to a standard 28 x 96-in. Cincinnati vertical Hydrotel milling machine, the Numill system provides point and path control over the full length of the two horizontal axes of motion, enabling the machine to combine milling and drilling operations with a maximum of speed and flexibility, Peck says. The head may be positioned vertically in a series of steps or elevations.

All movements of the machine slides (horizontal axes) are measured by an

TAPE CONTROL SYSTEM developed by Autonetics Division of North American Aviation, Inc., has display panel (upper left) to guide operator in milling operation. Console for tape reader, which selects part of magnetic tape that contains information to produce a part or tool, is at left. Richard Weidler scans electronic research mechanic, presses control pendant button to start template milling operation.

Autonetics developed digital gage which senses interference patterns generated by optical gratings and provides highly accurate measurement over distance of eight feet or more. Machine movements are translated in pulses, each representing 0005 in. Direction of movement is sensed and indicated as "add" or "subtract" pulses.

Production of a typical template is as follows:

The machinist sets number dials on the tape reader console corresponding to the desired part. The tape reader searches and finds the required portion of the magnetic tape, since information to produce several hundred different parts may be stored on this tape.

The operator then selects the proper material and cutting tool, such as a drill, from instructions flashed on the display panel.

The machine automatically drills a series of holes into which the operator inserts and fastens lag screws to hold the material.

If additional drilling is required, the display panel will indicate the drill size and rpm. When the setup changes are made, the required holes are drilled automatically.

Subsequent scribing and milling operations are done in a similar manner. The display panel indicates all setup instructions to guide the machine operator at each stage.

The Numill controlled machine mills any contour desired at speeds up to 25 in. per min., although capability exists for controlling machine movements at speeds up 200 300 in. per min., Peck said.

In drilling operations, the machine moves from one point to another at 120 in. per min.

Transistors are used throughout the control system with highly satisfactory results, Peck said. A major portion of the circuitry consists of plug-in boards of standard designs.

Convair engineers also have devised a system for tape control of milling machines (AW Mar. 28, 1955, p. 36).

PRODUCTION BRIEFING

Hunter-Bristol Corp. is the new name of the Hunter Manufacturing Corp., Bristol, Pa., manufacturers of jet engine and aircraft thrust stands, high speed rocket sleds, electronic test equipment, igniters for rocket motors and other ordnance equipment. Sales for the fiscal year ending Sept. 30 were $3 million.

Tapered Air Products Corp. Lynwood Calif., has received a Lockheed Aircraft Corp. contract to mill integrally-stiffened wing skins as well as

The fatal sting...

defending the B-52 intercontinental bomber is the Arma MD-9 fire control system that picks up, tracks, and with uncanny accuracy fires at its target

Developed and produced by Arma, the MD-9 is just one of Arma's capabilities in advanced weapon systems

If you have an "ARMAment" requirement, or would like to work with a leading engineering team, contact ARMA . . . Garden City, N. Y. A division of American Bosch Arma Corporation

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ADVANCED ELECTRONICS FOR CONTROL

other structural components for Lockheed's Electra turboprop airliner.

Martin Aircraft Co., Baltimore, Md., worker makes a close tolerance flush rivet countersink with Martin's new self aligning countersink machine. When

the worker moves the vertical handle, the machine's air cylinder moves the air driven drill towards the skin. The drill is universally held in a gimbaled mount (the 6 in. diameter ring near the drill head). Three microswitch feelers spaced around the drill must all make contact with the skin or the solenoid which starts the drill will not operate.

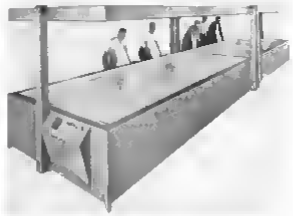
When the proper depth has been reached, a pressure pad on the countersink forces the unit away from the skin, opening the microswitches and stopping the drill. On supersonic aircraft, rivet heads must be held within a few thousandths flushness of the surface of the surrounding skin. This machine does a countersink in 6-7 sec against 30 sec for a hand held drill.

Holley Carburetor Co., Detroit, Mich., and Joseph Lucas (Industries) Birmingham, England, have signed an agreement whereby the two companies will exchange all patent and technical information relating to gasoline injection systems.

Miller-Trojan Co., Troy, Ohio, makes this contact printer for transferring lift layouts from the glass cloth on which they are drawn to the templates or sheet metal parts to be used in factory fabrication. First a photographically sensitized solution is sprayed onto the template material. Next the translucent glass-cloth drawing sheet is laid on the contact printing machine's glass work table. Then the sensitized surface of the template is laid face down on top of the glass cloth and the lid of the

Harnesses 3,250 Hp.

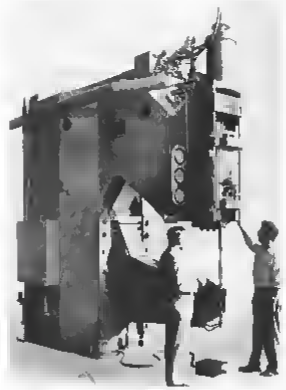
This control room, part of Trans World Airlines new $25 million overhaul base near Kansas City, Mo., records the operation of one of TWA's 3,250 hp. Wright Turbo Compound engines being tested with a 5,000 hp. capacity dynamometer (both visible through window). TWA says that this is a new use for dynamometers. The dynamometer, made by the Clayton Manufacturing Co. (AW May 23, 1955, p. 68), replaces the traditional wooden club propeller. Instead of wastefully dissipating the running engine's energy, the dynamometer converts the engine's power into steam which is used to supply TWA's entire overhaul base with 25% of its heating requirements in winter and 50% of its air conditioning needs in summer. TWA has five engine test cells and associated control and engine preparation rooms. The facility cost $1½ million.



machine is closed by switches on the instrument panel. The bottom surface of the lid has a rubber bag which, when evacuated, presses the template flat against the glass-cloth layout. The 120 fluorescent lights underneath the machine's work surface expose the sensitized film on the template, reproducing the lines on the glass-cloth layout after which the template is removed and developed.

The whole process takes only minutes according to Miller-Trojan.

The printer shown measures 72 x 360 ft. but Miller-Trojan also makes sizes down to 38 ft. x 50 ft. Various combinations of colored lights can be installed for printed circuit and diazo work.



Super Size Welder

This 58 000 lb., 13½ ft. spot welder was designed with a special throat clearance area of approximately 2100 sq. in. to accommodate a portion of the tail section of the Boeing 707 jet airliner now under construction. The machine is the largest resistance spot welder of its type ever built, according to its manufacturer, Federal Machine and Welder Co. The unit, a three phase frequency converter spot welder, incorporates a 25,000 lb. unipolar transformer which supplies the 100,000 amps. of current required for welding.

MAN IN sled being catapulted down Daisy Track at Holloman Air Development Center. Piston on front of sled will enter water filled cylinder at end of track, causing sled to decelerate abruptly.

ARDC Sled Tests Ejection Impact Force

Holloman AFB, N. M.—Air Research and Development Command is catapulting human volunteers along a 120 ft. sled track at Holloman Air Development Center to determine the best position for a man to assume during emergency ejection from a high-speed aircraft.

The new track—called the "Daisy Track," after the Daisy air rifle because it soon will be propelled by a compressed air catapult—consists of two rails 5 ft. apart and 3 ft. above the ground. The track is supported by a steel structure bolted to reinforced concrete.

The volunteer is strapped into a seat that is tilted on its side on the 350-lb. tubular steel sled. In this position, with his spine toward the front of the sled, the volunteer can be rotated at various angles with respect to the sled's motion to determine tolerance to impact in sitting positions.

Deceleration Effects

The project is part of the Aero Medical Laboratory's research into biodynamics—the investigation of effects of high impact forces on living tissues.

This program includes studies of windblast and the effects of relatively high G forces on the human body, including the work done by Lt. Col. John P. Stapp and others on Holloman's 3,500 ft. rocket sled track.

The Daisy Track is used to study the effects of abrupt deceleration impact on the spinal column and the physiological and psychological effects of abrupt deceleration.

The sled is now accelerated by an ejection seat catapult with a thrust of 3,100 lb. With the "air gun" for propulsion the sled will reach a maximum velocity of more than 100 mph. and

LT. WILBURN C. BLOUNT, former project officer, is on his side in sitting position so he can absorb greater impact forces. In this position the volunteer can be rotated at various angles with respect to the sled's motion to determine tolerance to impact in sitting positions.

have an acceleration-deceleration range of from 5 to 200 Gs.

Lt. Wilburn C. Blount, former project officer who was recently discharged, endured abrupt impact deceleration of 25 Gs from a speed of 30 mph., stopping in less than two feet.

The present project officer is First Lt. Eli L. Beeding.

Acceleration Measurements

Other volunteers who have ridden the sled include Capt. Clinton D. Hughes, Lt. Sidney T. Lewis, Lt. Charles A. Stemmetz, A/1C Moses Coleman and A/2C B. J. Teal.

Heinz Schmage of Holloman's Ballistic Missile Test Directorate designed the track.

Volunteers wear regular flying suits. They are strapped into position with nylon webbing. The sled is stopped by a piston type water inertia brake consisting of a piston on the front of the sled and a matching cylinder mounted at the end of the track.

Accelerations are measured by accelerometers mounted on the volunteer and on the sled. Cables attached to the sled allow an oscillograph to record accelerations.

High speed cameras at the end of the track record the various movements of the sled, seat and volunteer at peak deceleration.

Small Tire for B-58 Supports Heavy Load

Light weight, yet very strong main landing gear aircraft tire, of completely new design and construction, has been built by The General Tire & Rubber Co. for Convair's B-58 Hustler supersonic bomber.

The 22 in. tire, called the Aircat, weighs 18 lb. Company engineers claim it will sustain more weight per pound of tire than any other tire ever developed by the rubber industry. General attributes the Aircat's great strength to its wide flat tread. Restraining plies are used to maintain its unconventional shape.

The tire is built of natural rubber and Nylon cord.

General says that the tire is also able to withstand the rapid rotational speeds developed during the B-58's takeoff and landing rolls because the Aircat has conquered what tire engineers call traction, one special type of distortion occurring at high rolling speeds.

General Tire believes the Aircat will "lift the curtain on a whole new area of tire development for the jet age." Variations of the tire have passed qualifying tests of other major aircraft designers and manufacturers and are forecasts extensive use on military aircraft of all types."

Analog Computer Borrows From Digital

By Philip J. Klass

New York—Hybrid analog computer that uses digital computer techniques to set up the problem automatically and record the solution was unveiled here during the recent International Automation Exposition.

Developed by the Berkeley Division of Beckman Instruments, Inc., the new device is a super-accurate version of the company's EASE (Electronic Analog Simulating Equipment) computer in combination with a digital output/input translator called DO/IT for short. A portion of the increased computer accuracy stems from the DO/IT feature.

A somewhat similar type of analog/digital computer is under development by Electronic Associates.

The new DO/IT feature offers a number of advantages:

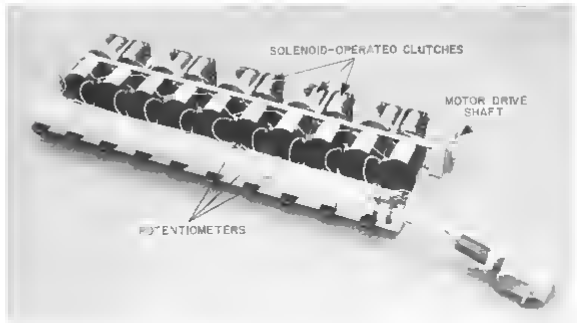
• **Speedy Set-up.** With conventional analog computers considerable time must be spent in setting dozens (or hundreds) of potentiometers to the desired values (coefficients). With DO/IT, this complete operation is performed automatically by pre-punched tape in a fraction of the usual time. The tape program also can set in desired values on the computer's function generators or electronic multipliers.

• **Less Chance For Error.** When dozens of pots must be set manually, there always is chance for human error. With DO/IT, when the tape program is fed into the computer it causes a Flexowriter to type out the desired (taped) value for each pot setting. When the computer's servo system has set the pot, it transmits back the pot identity and actual setting value which is typed out underneath the desired value by the Flexowriter.

• **Greater Utilization.** Lengthy set-up time required for a large analog computer of conventional design makes it impractical to use the machine for more than one problem at a time. With DO/IT, in combination with easily removed patchboards, the computer set-up can be changed quickly from one problem to another, thereby permitting multi-shift use of the machine around the clock if desired. Berkeley says a 200-amplifier computer can be re-set by DO/IT in 30 minutes, compared with up to eight hours to perform the same task on a conventional machine.

• **More Accurate.** Use of tape-controlled servo systems to make pot settings permits a 10-fold improvement in setting accuracy over previous manual setting techniques by eliminating errors introduced by non-linearities in pot winding. Berkeley says its new Series 1100 computers with DO/IT can position pots to an accuracy of 0.005% of full scale.

NEW analog-digital computer uses punch tape programming to set up problem automatically and record its solution on tape, increasing flexibility, utilization.



COMPUTER potentiometers are servo-driven to desired settings automatically by solenoid operated clutches.

Program Flexibility

The company expects that DO/IT will open the way to using very much larger analog computers, with many more elements, without the low utilization that would otherwise result from lengthy set-up time.

The new Series 1100 EASE computer is not only set from punched tape, but it automatically reads out its solutions in digital form so they can be recorded on punched tape, and printed out on the Flexowriter.

Even though the computer is programmed by tape, the human operator

can still change any pot setting at will. This is accomplished by push buttons, two of which select the desired pot, the remaining four entering the desired pot setting.

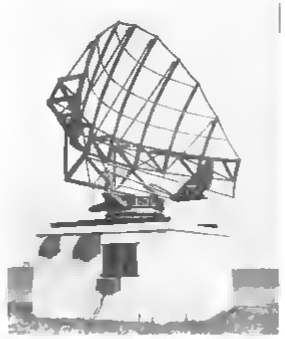
If a considerable number of the originally programmed pot settings must be changed manually during the course of running a problem, the DO/11 system can automatically scan all the pot settings in the computer and make a punched tape of the revised setup.

The DO/11 feature is particularly useful in running survey type problems where one or more parameters are changed after each run to produce a family of curves, Berkeley says. The tape can be programmed to set in one series of values on the pots or function generators, run the problem, record the answer on tape, then automatically proceed to change certain pot settings and repeat the run.

Improved Accuracy

Accuracy of the new Series 1100 computer has been increased by a factor of 10 over its predecessor, the 1032, Berkeley says. Part of this improvement comes from the servo null setting of pots which automatically positions their wiper arms to the desired value within one turn of the winding. The pots have 3,600 deg of rotation.

The program tape prepared by a



British Radar

Increase in orders for new 50 cm crystal controlled surveillance radar are reported by British Marconi's Wireless Telegraph Co. Ltd., following initial installation at London Airport. In addition to military procurements by British Ministry of Supply, Marconi reports that new radar will be installed at Gatwick, Britain's second largest civil airport, Elmdon Airport at Birmingham, Melsbroek, Belgium's largest civil airport, and Jan Smuts Airport, the largest in South Africa. A second installation of the new S 232 radar is planned also for London Airport.

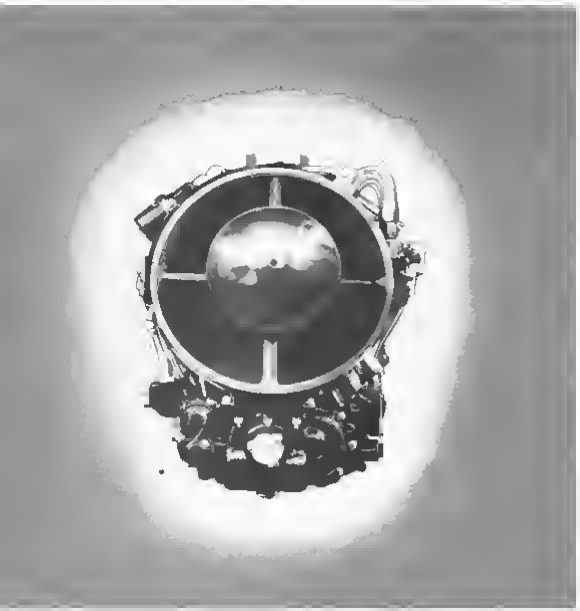
General Electric's New T58 Turboshaft Engine

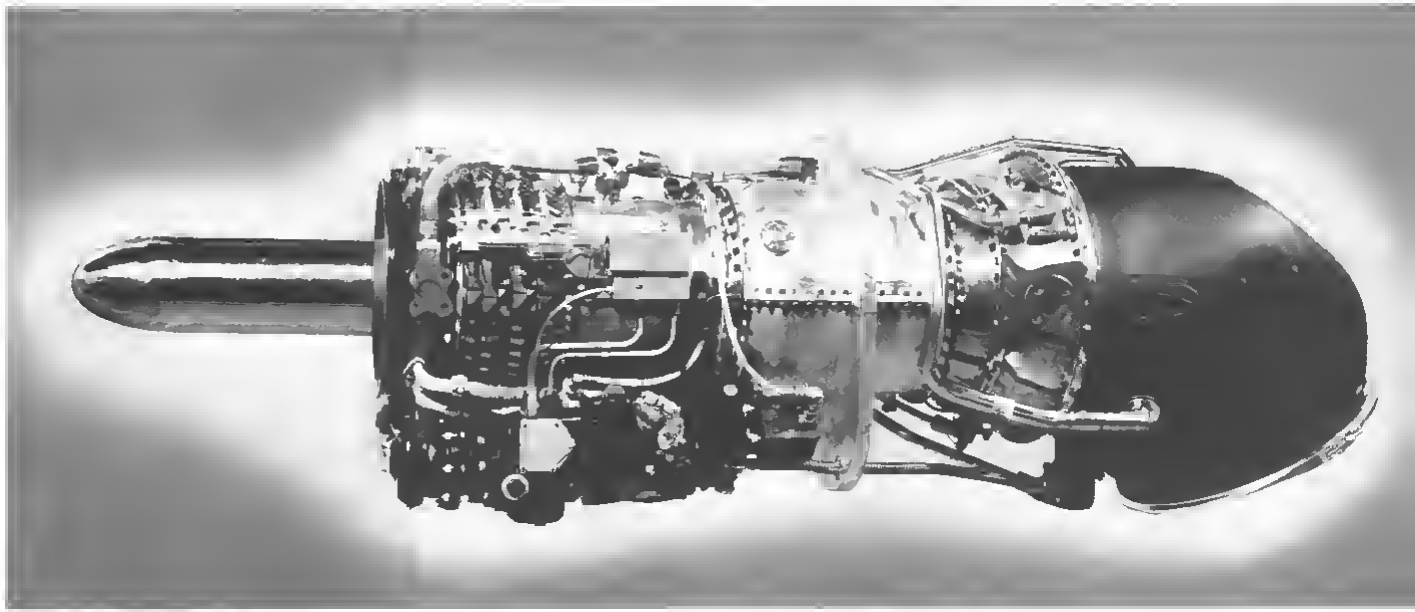
1050 HP

0.67 SFC

Offers small aircraft economical gas turbine pawer . . .

new levels of perfarmance and operating efficiency





A high performance, axial-flow gas turbine, the T58 is designed to power helicopters, small transports, convertiplanes and other VTOL or STOL type aircraft into a new era of flight.

Inside a shell 55 inches long by 16 inches in diameter at maximum flange, the T58 incorporates the most modern compressor design, straight-thru full-annular combustor, 2-stage axial-flow gas generator turbine, and single-stage free power turbine.

Now . . . gas turbine power economically tailored to the needs of small aircraft. From the T58's basic axial flow design comes a new power to weight standard: 1050 horsepower from 250 pounds of engine! And the T58 makes this power available with a specific fuel consumption of 0.67 at normal rated power.

These features promise an era of flight marked by outstanding aircraft performance and operating efficiency. Yet they are but a few of the many advantages the T58 will offer wherever it flies. The T58 will operate on a variety of low-cost fuels, and its simplified construction will assure easy maintenance, installation flexibility, and long engine life.

Backed by the experience that created such famous aircraft gas turbines as the J47 and J79 turbojet engines, the T58 is the product of Navy vision and the engineering skill of General Electric's Small Aircraft Engine Department in Lynn, Mass.

Find out what the T58's many features can mean to your aircraft. Call your local General Electric Aviation & Defense Industries Sales Office, or write: General Electric Co., Sect. 233-4, Schenectady, N. Y., for the T58 descriptive bulletin.

All figures based on engine without helicopter reduction gear. Gear weight 75 lbs.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Flexowriter, lists the identity of each pot to be set according to its "address" within the computer and the coefficient value to which it must be set. This latter value is converted in the computer from digital form into an analog voltage.

The address information is used to actuate a small solenoid operated clutch which engages the particular pot shaft to a master servo motor.

The servo system then drives the pot until its voltage cancels out (nulls) the voltage set up by the tape program. Each pot has its own individual clutch but 50 pots are served by a single servo motor. A pot can be set to any desired value within three seconds, Berkeley says.

Oven Mounted

The remainder of the Series 1100's improved accuracy stems from the use of improved resistors and capacitors which can be matched and adjusted to within 0.005%, according to Allan McLane, senior computer development engineer. These passive elements also are mounted in an oven whose temperature is maintained to within 0.8 degree to prevent change of component values.

The new computer includes push button provisions for static and integrator problem checking to insure that patch board has been properly wired and that components are operating properly. The Model 1132 with 60 amplifiers, has a 2,200 hole patchboard; the 100-amplifier Model 1132 has a 3,600 hole board. The patch boards use Aircraft Marine Products' cellular, shielded and insulated patching system consisting of molded nylon blocks alternated with interlocking metal strips to prevent terminal to terminal leakage.

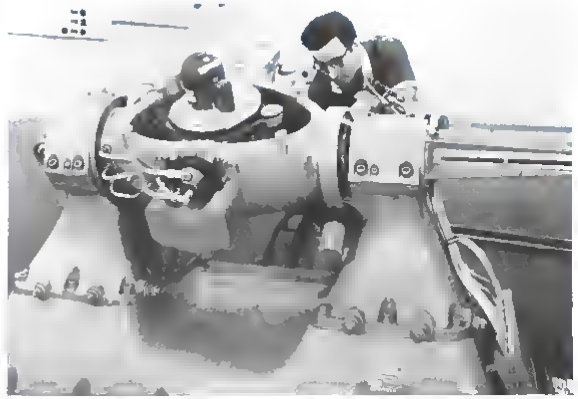
The desired mode of amplifier operation (integrator, summer, or high gain) is selected by patch chords on the board.

This keeps the entire set up on the patch board and eliminates need for disconnecting computer power when the patch board is removed.

Price: $90,000-$100,000

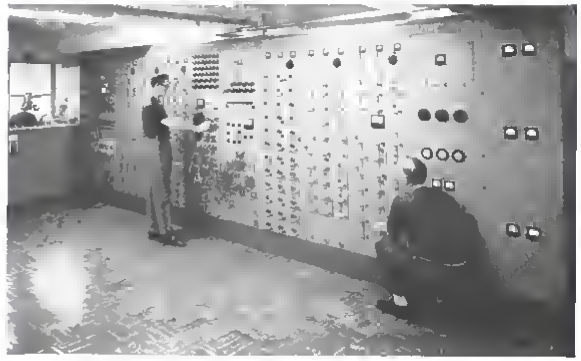
The unit which Berkeley displayed here, consisting of 60 amplifiers, 10 electronic multipliers, three function generators and two servo resolver units is priced at approximately $90,100,000. This price includes the Flexowriter equipment.

This is about twice the cost of a non-automatic analog computer with comparable capacity, Berkeley says. However, the DO/IT feature is expected to more than pay for itself by the increased utility and versatility which it provides for the basic analog computer.



Missile Simulator

Dynamic three-dimensional missile flight simulator consisting of hydraulically driven flight table (above) and analog computer (below) permits realistic duplication and analysis of missile control system performance. Developed by Bendix Aviation, two of the systems are now in use at North American Aviation (Los Angeles) and in Detroit, operated by Bendix for the Navy. Third unit will soon be delivered to Navy's missile center at Pt. Mugu, Calif. Gyros can be mounted on flight table which simulates motion of missile about all three axes in response to signals from analog computer, which is set to duplicate missile's aerodynamic characteristics.



FILTER CENTER

▶**A Profitable Climate**—Puerto Rico's 43 electrical-electronic manufacturers showed average net profits of 33% of sales, compared to U.S. average of 5%, according to Puerto Rico's Economic Development Administration. Puerto Rico's tax free incentive instituted to attract new industry, is one explanation for higher profits.

▶**Another Russian "First"**—On the heels of the National Company's recent demonstration of its Atomichron, an atomic frequency reference (AW Oct. 22, p. 103), the Russians now claim to have developed a more accurate atomic clock. Because the Atomichron is far more accurate than any available device for measuring its accuracy, National conservatively quoted its accuracy as one part in a billion—the equivalent of a clock that loses three seconds in 100 years. Russians now claim their atomic clock loses only one second in 300 years and is the most accurate in the world. In rebuttal, National points out that during its recent Atomichron demonstration in which two of the units

were operated "synchronously," in effect using one unit to check the accuracy of the other, an accuracy of one part in 100 billion was obtained. This is equivalent to a loss of one tenth second in 300 years. No counter-claims yet from the USSR.

▶**New Business**—New research, development and production contracts recently reported by avionics manufacturers include:

• **Motorola** $1 million transistor development contract from Signal Corps Supply Agency.

• **Kaar Engineering Corp.**, Palo Alto, Calif., $409,000 contract from Civil Aeronautics Administration for VHF transmitters.

• **Logistics Research, Inc.**, Redondo Beach, Calif., reports sale of two of its ALWAC digital computers to North American Aviation and Litton Industries, making the second such computer purchased by NAA.

▶**Tomorrow's Technicians**—"Your Career in Electronics," a new 16 mm color movie prepared by Radio Corporation of America Institutes (a technician trade school) is available for high school showings to familiarize students with the role of the technician in industry. Running time is 24 min. For booking information, write to Registrar, RCA Institutes Inc., 350 West Fourth St., New York 17, N. Y.

▶**K-System a Big Job**—Complexity of the Sperry K Type bombing navigation system used on the B-47 and B-52 can be realized from following figures released by company:

• **One million factory workers** and technicians in 36 states at 3,050 companies were directly engaged in producing the system for USAF.

• **More than 70,000 parts** go into the system, including hundreds of vacuum tubes more than 50 motors and about 100 relays.

▶**RCA Data Link Confirmed**—Radio Corporation of America has confirmed AVIATION WEEK's report (Nov. 5, p. 103) that it has received USAF contract to develop a complete air-ground data link system to be used by both USAF and Navy for air defense, air traffic control and other weapon systems.

▶**Needed Research Pinpointed**—Recent Defense Department report describes specific areas in electronics field which need more basic research. Areas discussed include antennas, wave propagation, generation of electromagnetic energy, solid state physics, information theory, plasma, electron and ion dynamics, atomic and molecular resonance, surface phenomena, data processing, prime power sources, nuclear radiation effects, materials, mathematical methods, network theory, underwater sound, and acoustics. The report, entitled Basic Research in Electronics, PB 121486, can be obtained from Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C. Price is $1.25.

▶**Aviation Computer Symposium**—Two-day symposium devoted to application of digital computers to aviation problems, including aerodynamics, structures, operations research, logistics, nuclear computations and probability, will be held Jan. 31-Feb. 1 at New York University, sponsored by NYU and International Business Machines Corp. For registration details write to Mr. A. S. Wolf, IBM Corp., 590 Madison Ave., New York 22, N. Y., or Dr. Max Woodbury, New York University, 401 West 205th St., New York, N. Y.

▶**New EAL Microwave Link**—Eastern Air Lines has completed an 84-mi. single-hop microwave link which will enable its Douglas Airport terminal at Charlotte, N. C., to remotely operate the Aeronautical Radio Inc. air-ground VHF station at Mt. Mitchell. The Motorola microwave system, operating at 6.7 kmc., provides voice link and control of two transmitters plus one duplex service channel.

▶**New York Claims Lead**—New York claims top rank among states in number of electronics firms, with a total of 500, according to State Commerce Commissioner. In fields of computers and instruments, the commissioner said that New York produces one third of the nation's output.

New Avionic Bulletins

• **Analog computer.** Series 400 operating features are described in 16-page brochure. Reeves Instrument Corp., 207 East 91st St., New York 28, N. Y.

• **Airborne electronics system for twin-engine aircraft** includes communication, navigation, flight instrumentation, flight control. (16 pp.) Collins Radio Co., Cedar Rapids, Ia.

• **"Airborne Analog Computer Flies Aircraft's Own Position on a Mercator Chart"** is title of a paper delivered at the recent Southwest District Meeting of the A.I.E.E. now available from Servo Corp. of America, 20-20 Jericho Turnpike, New Hyde Park, N. Y.

• **Deposited carbon precision resistors,** application data and performance data. Bulletin B-4 (4 pp.) Bulletin B-5 describes molded boron carbon resistors. International Resistance Corp., 401 No. Broad St., Philadelphia 8, Pa.

• **Precision potentiometer,** Series 7700 10-turn. Helipot is described in Data Sheet 5486. Helipot Corp. Technical Information Service, Newport Beach, Calif.

• **Filtered d-c power supply** specifications and application data on Model NFA. Electro Products Laboratories, 4500 No. Ravenswood Ave., Chicago 40, Ill.

• **Lightweight automatic direction finder,** Type 21, weighing less than 20 lb. is de-

scribed in four page brochure. Write Aircraft Radio Corp, Boonton, N. J.

5,000 Volt d.c. power supply, Model PS-503 weighs only two pounds and measures 4 x 2¼ x 2½ in. operates from 22½ v.d.c. Servo Corp. of America, 20-20 Jericho Turnpike, New Hyde Park, N. Y.

Precision potentiometers, linear and non-linear, in one, three and 10 turn models capable of operating at temperatures up to 300°C with derating are described in technical bulletins 63 and 64. Electromatic Corp., 190 Henry St., Stamford, Conn.

Filter set, one-third octave, Model EL-1609 for sound and vibration analysis consists of 27 flat-topped filters each with 23% octave bandpass width plus seven additional filters available as optional equipment. Catalog sheet is available from Ballish Electronics Co., 5405 Perkins Ave., Cleveland 14, Ohio.

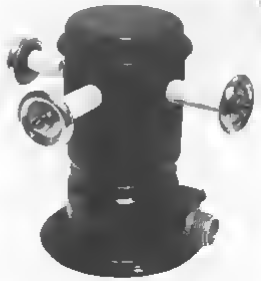
NEW AVIONIC PRODUCTS

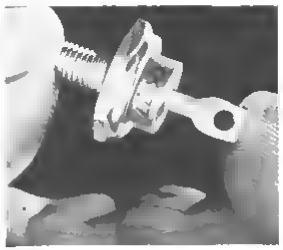
Components & Devices

• **Non-magnetic sensitive relay,** called Capiswitch, can be actuated by as little as one milliwatt second of energy with pulse duration as short as 5 microseconds. As little as 50 microwatts will keep contacts closed. Relay uses two electrostrictive ceramic capacitive elements which change dimensions when

voltage is applied, thereby closing contacts. Manufacturer says 100 of the devices have been operated 50 million times without single case of fatigue or failure. Relay measures 1⅞ in. dia. x 3¾ in., weighs 1¼ oz. Mullenbach Div., Electric Machinery Mfg. Co., 2100 E. 27th St., Los Angeles 58, Calif.

• **Vacuum transfer relay,** Type JGF-RE2 for antenna transfer switching use in high altitude aircraft comes in SPDT model rated for 5 kv operation at altitudes up to 50,000 ft. Continuous current rating is 10 amps at 24 mc. Switch is not damaged if accidentally switched with power on. Jennings Radio Manufacturing Corp., P.O. Box 1278, San Jose, Calif.





• **Silicon power rectifier,** Type CK777, with peak inverse rating of 325 v. has average current rating of 5 amps at 125C with maximum reverse current of 5 ma. at 325 v. Maximum forward voltage drop is 2 v. at 10 amps. Raytheon Manufacturing Co., Technical Information Service, 55 Chapel St., Newton 58, Mass.

USAF to Test Two New Runway Cleaners

Two new candidates for the task of vacuum cleaning miles of jet runways, taxi strips and parking aprons have been delivered to USAF's Wright Air Development Center at Wright-Patterson Air Force Base for functional and operational suitability testing.

Bolts, nails, tumbleweed, stones, wood, rope—and sometimes even jack rabbits and prairie dogs—inhaled by gas turbine engines cause $25 million damage yearly, USAF estimates. At a single air base in a six month period, USAF reports foreign matter ingestion was responsible for 46 jet engine changes.

Powerful vacuum cleaners are preferred over brush-type sweepers because brushes do not pick up foreign material in runway cracks and crevices. Jet aircraft at full take-off power can suck this rubble into their air intakes, sometimes causing instantaneous engine failure.

Two Types

One of the two cleaners has a long, ground level intake nozzle in front. Called the "Cole-Vac" to identify it as a vacuum rather than a brush-type cleaner, it is manufactured by Coleman Engineering Co., Inc., of Los Angeles. Two machines have been developed for USAF's Air Research and Development Command.

The other type is a 25-ton truck-trailer combination. The trailer houses the two ton power units which create suction velocities of up to 500 mph. in a 10-ft. steel nozzle mounted under the trailer.

The machine was made under a $100,000 Air Force research and development contract by Wayne Manufacturing Co., Pomona, Calif.

Cole-Vac

The Cole-Vac is built on a standard truck chassis which was reversed to give rear-wheel steering for a shorter turning radius.

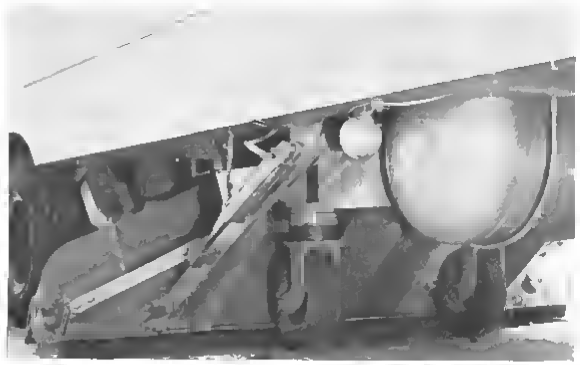
Power steering and brakes and automatic transmission simplify operation of the cleaner.

Two engines are mounted in the rear of the machine, one to propel the unit, the other to power the vacuum system.

It can operate at average automobile speeds.

The vehicle is controlled by an operator in a cab mounted high at the rear, above the engines where he has unobstructed vision in all directions. Two-

RUNWAY vacuum cleaner made by Coleman Engineering Co. has nozzles in low front unit. Hoppers for debris are mounted under separator drums in center.



SWEEPER made by Wayne Manufacturing Co. is housed in semi-trailer unit (top). Ten foot vacuum nozzle (below) can pick up objects as large as 3-in. steel cylinders.

way radio keeps him in touch with the control tower.

Dual nozzle intakes are located at runway level at the front of the machine.

Auxiliary swivel wheels help to support the weight of the large structure. Headlights are provided.

Features of the front end of the machine are:

- Hydraulically operated mechanism to raise the nozzle when the machine is not cleaning to provide greater ground clearance for road travel.
- Pass-marker device which marks the path the cleaner has covered.

Debris picked up by the nozzles goes through two drum-like separators whence the foreign matter is deposited into dual hoppers on either side of the vehicle.

The hoppers can be emptied automatically by the operator.

Special abrasion resistant steels are used in fabricating the nozzle, ducting and hoppers to minimize the wear and erosion by the debris.

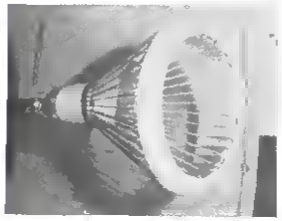
Wayne Cleaner

The Wayne cleaner, using the 25-ton truck-trailer combination, has all the power and suction machinery housed in the trailer which is 35 ft. long, 14 ft. high, and 8 ft. wide.

A 610 hp. V-12 gasoline engine drives a 32 blade, 39 in. diameter, two-stage blower at 3,400 rpm. to create the vacuum required. It is strong enough to pick up one pound chunks of steel while the cleaner is traveling at 25 mph.

An 8 ft. square bank of 132 vane-type centrifugal filters retains heavier rubble in a plenum chamber whence they drop into a hopper. This protects the blower blades, which are subjected only to fine dust particles. The blower exhausts through a funnel on top of the trailer.

A specially designed control panel



A4D Drogue

This collapsible drogue, the rim of which is inflated to make it hold its shape, will be used by Douglas on an A4D-to-A4D Buddy type in-flight refueling system. Unit is made by Dalmo Victor Co., San Carlos, Calif.

in the driver's cab electronically activates all vacuum cleaning mechanism in the trailer, allowing for one man operation.

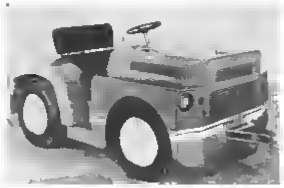
Wayne, which claims to be world's largest producer of power sweepers for cities and industry, predicts that commercial versions of the runway vacuum cleaner will eventually be available.

Three Flash Types Tested for Air Photos

Improved night photo-reconnaissance systems in Republic RF-84F's and Douglas RB-66B's are being tested at the Air Force Operational Test Center, Air Proving Ground Command, Eglin AFB, Fla.

Three different types of photo-flash cartridges and bombs are being used in the tests: the M-112 with a light peak of 110 million candlepower; the M-123 which provides 260 million candlepower and a 165 lb. photo flash bomb which puts out 4½ billion candlepower. Burning magnesium produces the flash in the three types.

As the cartridges begin to produce light—the duration of the flash is about 1/25th sec.—a photoelectric cell in the plane sets the camera into action, snapping the shutter as the flash reaches its peak 1/2,000 sec. from ignition.



Tow Offers 8,000 lb. Top Starting Pull

New tow tractor with a fluid coupling drive which gives 8,000 lb. maximum starting drawbar pull is being produced by the Industrial Truck Division, Clark Equipment Co.

Called the Clarktor 80, the vehicle features a low, 56½ in. silhouette for

Vulcan Test Installation

Vulcan six barrel rotating 20 mm. cannon for arming USAF's F-104, F-105 fighters and B-58 supersonic bomber (AW Sept. 3, p. 28) is mounted in a test installation aboard an F-94 fighter. Cyclic rate of fire of Vulcan, developed by Army Ordnance, USAF and General Electric Co., is around 7,000 rounds per minute. Barrel cluster rotates counter clockwise (looking from breech) is powered either by external electric or hydraulic drive. Ammunition is electrically primed.

from protruding accessories and a turning radius of 146 in.

The machine, which is 107 in. long and 69 in. wide, is powered by a six-cylinder, 230 cu. in. displacement Chrysler engine. Its maximum forward speed is governed at 16 mph.

Exposed parts are covered with a weather resistant paint. All six tires are the same size.

OFF THE LINE

Greer Hydraulics, Inc., established a new general sales organization to serve its customers in the field better. Organization embodies a Central Sales Administration at the company's head office at New York International Airport. Reporting to this office are four area managers—Eastern District with offices in New York, Mid-West District, Chicago, Southwest, Dallas, and West Coast, North Hollywood.

Aeronautical Division has been formed by T. R. Finn & Co., Inc., manufacturer of shock and vibration mount controls. New division, which is in production, specializes in prototype fabrication of complex welded assemblies used in jet, ramjet and rocket engines. The firm currently is working on contracts for Reaction Motors, Wright Aeronautical and Experimental Divisions of Curtiss-Wright.

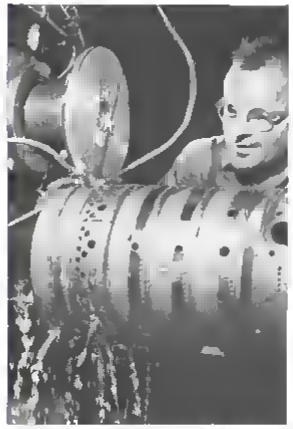
Electronic Coffee

Trans World Airlines planes now have fresh coffee brewed on board with this electronic coffee brewer, a product of Higgins-Young Coffee Co. of Los Angeles. Brewer, shown installed in galley of a Super G Constellation, contains an electronic timing device. It takes three minutes to make a nine cup pot. Previously, coffee had to be carried on board in a thermos jug due to technical difficulties of brewing coffee at altitude where water boiling point lowers.

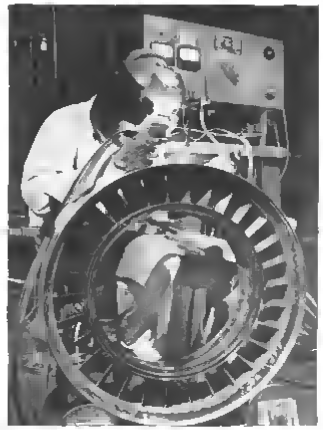
Welding Widens Use in Engines

PRATT & WHITNEY has developed new welding techniques using a metallic inert gas process.

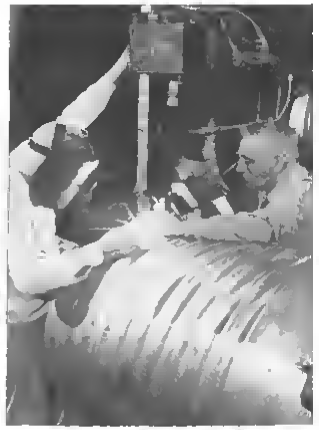
FLASH butt welding machine welds titanium at 3,200F. Electricity is used to erode portions of the titanium parts while they are being forged together.



COMBUSTION chambers are resistance welded by water-cooled welding wheels. Welding is used on 76 major J57 parts.



HAND-HELD tungsten unit with inert gas to prevent adverse reaction of molten metal is used to weld vanes to outer case.



IN THIS fusion welding operation, inert gas is used to prevent contamination of nickel alloy component.

These turboprop propeller blades begin as alloy steel billets

Model CT634S of the Curtiss-Wright Turbolectric series was the first U S -designed and built turboprop propeller to be certificated for commercial use by the Civil Aeronautics Administration This model and others are already in quantity production for military aircraft

Turbolectric propellers use extruded hollow steel blades produced by the controlled extrusion process developed by Curtiss-Wright. The extruded blade begins as a single-piece alloy steel billet

With the development of this propeller and the controlled extrusion process came the need to select the right alloy steel. And here's where teamwork paid off

Republic metallurgists, working closely with Curtiss-Wright metallurgists and engineers, selected an alloy steel with the following properties that make the extrusion process successful from both a production and cost standpoint: freedom from imperfections, uniform response to heat treatment, workability in all stages, weldability, bendability—hot or cold.

These properties in combination with the extrusion process give.

(1) IMPROVED STRENGTH-WEIGHT RATIO. The tough, integral structure of the extruded alloy steel blade provides greater strength and resistance to fatigue with minimum weight.

(2) IMPROVED QUALITY. Greater uniformity is assured by fabricating from a single homogeneous material.

(3) INCREASED PRODUCTION. The number of manufacturing operations is reduced. Production per hour is increased. Floor space is saved.

(4) REDUCED COST. Less steel for original stock, less machining, and lower cost tooling and equipment are required. Expensive welding and accompanying preheating and post heating operations, as well as milling operations, have been reduced.

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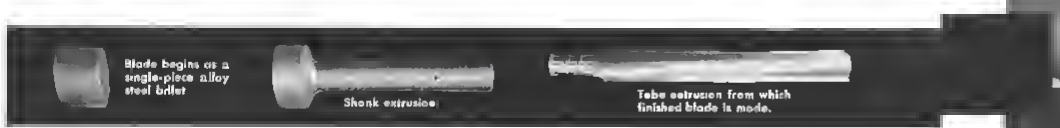

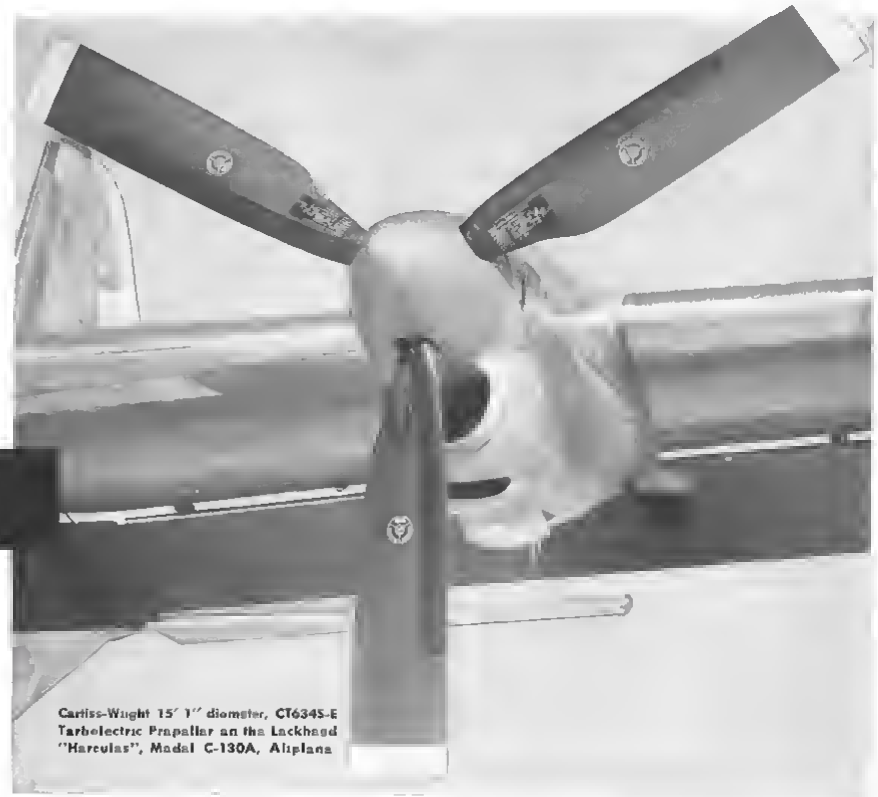

Curtiss-Wright 15' 1" diameter, CT634S-E Turbolectric Propeller on the Lockheed "Hercules", Model C-130A, Airplane

Strength-to-Weight or Heat Problems—Republic Has the Answers

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K-9681

Cessna Modifies 1957 Designs, Prices

By Erwin J. Bulban

New York—Many design and style changes are evident in the 1957 Cessna Models 180 and 182 which will be shown to prospective customers for the first time during nationwide showings Dec 15-16 by the company's distributors and dealers.

Price increases also are noticeable. In the case of the Model 182, the factory flyaway bill will be $13,975, up $225 the Model 180, having the tail-wheel landing gear, will cost $13,250, a $300 increase over 1956.

Model 182 has undergone the most revision, particularly in the landing gear. The main gear has been lowered four inches, the tread has been widened 5.4 in. and the nose gear strut has been shortened two inches. These modifications are aimed at providing improved ground handling, takeoff and landing characteristics by making the 182 less susceptible to high or gusty winds.

Additional strength has been incorporated by thickening the main gear spring steel legs from ½ in. to ¾ in. also the tires will be six ply instead of the former four ply. The 180 landing gear remains the same, but castering wheels are now standard equipment.

Shortening the nose gear changes the 182's ground attitude, this is now approximately seven degrees instead of five degrees. There is no change in propeller ground clearance. Cessna maintained the original clearance by rotating the entire fuselage downwards using the propeller hub as the axis.

IMPROVED GROUND STABILITY is aim of lower, wider Model 182 landing gear (top photo). Revised instrument panel groups dials functionally, provides room for more radio gear.

New Interiors

Most noticeable interior changes are relocation of flight instruments to provide a more functional layout and provide more area for additional instrumentation and radio.

The engine group has been clustered and includes electrical fuel gages replacing the former float type quantity indicators mounted in the wing root inside the cabin. Another addition is installation of a generator indicator light which remains lighted until charging begins. The light which replaces the former ammeter also serves as a master switch indicator light when the engine is not operating. The compass has been moved from the panel and is now windshield mounted and the airspeed indicator is calibrated both in knots and miles per hour. A fuel strainer drain valve has been added, operating from a control knob below the instrument panel, to allow straining water or sediment from the bowl.

Relocation of instruments allows installation of four radios without deleting the map compartment, the company notes.

A new door latch has been designed for the 1957 models incorporating a flush exterior handle and a sliding bolt mechanism to replace the cam-type latch. Hand braking is now accomplished by a automobile type handle in place of the former panel mounted knob that had to be pulled while pressure was applied to the pedals.

Redesigned Seats

Seats have been redesigned to provide better posture and comfort, the front seats have a stronger frame with additional one-inch overhang and square recessed backs. Rear seats have squared backs for additional support and the four position adjustment is more accessible.

Two new color combinations are

NEW INTERIOR and castoring landing gear are standard equipment in 1957 Model 180.

available for 180-182 interiors. Target Red with White and Cascade Green with Tan Exterior color styles available include four combinations: Sunstone Yellow, Empire Green, Jamaica Coral and Palomino Cream with black trim.

Gross weight of the Model 182 is up 100 lb. to 2,650 lb. Powerplant remains the Continental O-470-L rated at 230 hp. The engine has new carburetor which is expected to improve fuel consumption.

Other exterior changes on the new airplanes include a Model 310 outside baggage door latch and key lock and a new engine cowling on the Model 180 to make removal easier and permit ready access to the engine without removing the propeller.

Sikorsky S-51 Does Variety of Jobs for Connecticut Agencies

Danbury, Conn.—Connecticut's Sikorsky S-51 helicopter, flown at the recent helicopter air show sponsored here by the New England Region of the American Helicopter Society, is owned by the State Department of Aeronautics for use by any state agency.

Connecticut state police are probably the biggest users of the S-51. Demand has been brisk, however, from other departments—usually for good, technical reasons, but sometimes for the novelty value.

The state owns two fixed wing airplanes, a Cessna 190 and a 170. Donald J. Lynch, assistant director of aeronautics for the state, said he has found more than one occasion where use of the helicopter has requested when the Cessnas would have served just as well.

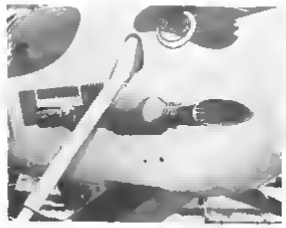
Fund Transfer

Costs of the helicopter are paid largely by the Department of Aeronautics.

Other agencies which use the S-51 are charged $28 an hour through a budget fund transfer system. Though this charge does not pay nearly what the operation costs, it helps hold down frivolous requests.

Since the S-51 was delivered in April, it has required about 130 hr. Lynch said preliminary cost estimates including amortization, fix the hourly operational expense at $74.

The state has found uses for the



SIKORSKY S-51 owned by the State of Connecticut was formerly operated by Los Angeles Airways (right). Muffler (left) was furnished by Maxim Silencer Co.

for helicopter which a fixed wing aircraft could not provide. Among them:

• **Terrain surveys.** The Highway Department, Lynch said, was able to complete in a morning a survey (for plant, road projects etc.) that a ground party would have spent a week on and not done as well.

• **Blasting surveys.** This is a problem important to Connecticut because of the construction under way for the New England Throughway. Contractors blasting at Greenwich, Conn., last summer set off an unexpectedly heavy charge that threw debris into nearby houses and knocked out the signaling system of the New Haven railroad. Now police hover over blasting sites. They can count the holes drilled for the charge insuring against too big a blast.

• **Traffic surveys.** What often is not evident to police on the ground or on maps becomes obvious seen from the hovering S-51. Capt. William Gruber, head of the traffic division of the state police, explained that one of the big summer traffic problems in Connecticut was the Sunday night flow back from Long Island sound to Hartford. Half-way to Hartford the traffic from the shores east of New Haven was forced onto two major highways which joined at Middletown as at the apex of a triangle.

Though maps had indicated the side roads were too winding to handle heavy traffic flows rapidly, a survey from the S-51 showed that many stretches of side road were actually direct enough for use. By selecting straight segments of various secondary roads from the air, police were able to make up alternate routes that relieved the situation.

In another instance, police were puzzled that traffic through one Connecticut town was often snarled even though a wide bridge was in use. Surveying the tangle from the hovering S-51, state police found that state troopers were forming traffic into four lanes on the highway while town police were holding traffic to two lanes on the bridge.

Traffic Lights

Study from the hovering S-51 also is useful in analyzing traffic light patterns. In one town, state police were able to eliminate eight traffic lights through helicopter traffic pattern surveys.

By publicizing the fact that the helicopter was in use for traffic control, state police found fast drivers tended to slow down because of the psychological effect. Slow drivers who caused jams could be spotted from the air and straightened out from the ground.

Search and rescue on Connecticut shores was expected to be an important role for the helicopter but so far no rescues have taken place. The S-51 is equipped with a hoist with a 75-ft cable and capable of lifting 300 lb.

Hunts for crime fugitives, possible victims or missing persons can be carried out easily from the helicopter. Ground markings become surprisingly legible, as where ground has been trampled by search parties, where automobiles have driven off roads into brush showing no returning tire tracks or where footprints lead into but not out of wooded areas.

Connecticut's S-51 was acquired from Los Angeles Airways where it had flown 5,000 hr. in mail service. Sikorsky Aircraft Division United Aircraft Corp. took the S-51 in on trade, fitted it out for passengers and put in a new Pratt & Whitney R985-B4 engine of 450 hp.

New Blades

Two metal blades replaced the old 3-blade wooden layout. A hydraulic servo control system was installed. Basic instruments and a floor socket were provided for dual controls in the rear seats.

The pilot, David E. Rosser, sits in a single seat forward, and there are three seats at the rear of the cabin.

Microphone and headphones for the police radio are placed in the rear so

U. S. BUSINESS & UTILITY AIRCRAFT SHIPMENTS

(January—September 1956)

Make and Model	Aircraft		Builder's Net Billing Price	
	Sept.	Jan.-Aug. Total	Sept.	Jan.-Aug. Total
Aero Design 560-A	5	41	$995,800	
680	18	56		$7,203,800
Beech 35 Bonanza	27	544	2,535,280	20,599,889
E185 Super 16	9	73		
B185	8	6		
50 Twin Bonanza	12	93		
45 Trainer	10	50		
Callair A-4	2	14	19,698	71,720
Camarr 460 Twin Navion	2	12	40,000	329,140
Cessna 170	1	70		
172	228	1,065		
180	21	424	2,472,440 92	27,573,495 35
182	45	682		
310	15	167		
Champion 7EC	18	137	68,900	539,203 46
Colonial C-1 Skimmer	2	2	34,000	34,000
Helio H-391B Courier	2	19	46,000	438,000
Leer Learstar Mk. 1	1	5	487,690	1,886,000
Learstar Mk. 2	0	1		
Mooney M18	0	9	93,400	494,606 65
M20	9	46		
Piper Super Cub PA-18		157		
Super Cub PA-18A	60	359	1,682,000	17,358,070 04
Tri-Pacer PA-22	72	828		
Apache PA-23	34	297		
Royal Gull P.136-L1	0	10	0	819,000
Taylorcraft Model 20	4	27	38,800	235,953 80
Totals	589	5,176	$8,471,698 92	$77,581,198 30

Source: Compiled by AVIATION WEEK

that police riding there can communicate directly with patrol cars on the ground.

The S-51 is equipped with LF and VHF air communications radio as well as the police FM radio. Except in emergency, police communicate with ground units for effecting arrests or clearing up traffic.

A muffler made by the Maxim Silencer Co. of Hartford was offered as equipment by Sikorsky and the state ordered it. Besides its general public relations value, police like the muffler because it prevents distraction of drivers when the S-51 is utilized for traffic work.

Beech Forms New Financing Unit

New York—To increase business plane sales volume by improving time payment purchase opportunities, Beech Acceptance Corp. has been formed by Beech Aircraft Corp., Wichita, Kan.

The new wholly-owned Beech subsidiary will offer these financing plans: a floor plan for dealers and distributors; a retail financing plan for business aircraft customers and a leasing plan for executive plane users. The company expects that the new organization will be particularly helpful to those of its smaller sales outlets who still find it difficult to enlist the aid of local banks on financing purchases of new aircraft.

Operating manager of BAC will be A. R. Bell, who has been financial planes consultant to Beech. Frank Hedrick, Beech vice president-coordinator, is president, and Mrs. O. A. Beech is board chairman. Board membership comprises O. A. Beech, A. R. Bell, Edward C. Burns, John A. Elliot, John P. Gaty, Leddy Greever, Frank E. Hedrick, Michael J. Neuberger and Dwight S. Wallace.

Shipments By Plants Manufacturing Complete Civil Aircraft and Engines For Civil Aircraft

	January-September	
	1956	1955
Complete aircraft, total airframe weight (thousands of pounds)	11,575 4	8,460 6
By weight of plane		
Under 3,000 lb airframe weight	5,242 7	3,390 7
3,000 lb airframe weight and over	6,332 7	5,069 9
By number of places		
1 to 5 place	4,662 1	3,006 6
Over 5 place	6,913 3	5,454 0
By total rated horsepower, all engines		
Under 399 hp	4,383 1	2,745 2
400 hp and over	7,192 3	5,715 4
Aircraft engines, number	8,762	5,562
Aircraft engines, total horsepower (thousands of horsepower)	3,968 1	2,462 2
Complete aircraft, number	5,662	3,634
By weight of plane		
Under 3,000 lb airframe weight	5,363	3,423
3,000 lb airframe weight and over	299	211
By number of places		
1 to 5 place	5,144	3,272
Over 5 place	518	362
By total rated horsepower, all engines		
Under 399 hp	4,962	3,116
400 hp and over	700	518
Value of shipments of complete aircraft and parts, total (thousands of dollars)	393,917	307,711
Aircraft, total	309,381	232,655
Under 3,000 lb airframe weight	77,324	47,964
3,000 lb airframe weight and over	232,057	184,691
Aircraft parts	84,536	75,056
Value of shipments of aircraft engines and parts, total (thousands of dollars)	176,494	104,214
Aircraft engines	73,825	43,838
Engine parts	102,669	60,376
Unfilled orders (number of planes 3,000 lb airframe weight and over)		
Sept	1,010	421

Exports of Aircraft, Parts, and Accessories

(Money figures in thousands of dollars)

	January-August			
	1956*		1955	
	Number	Value	Number	Value
Aircraft parts, and accessories, total		763,219		502,146
Commercial and civilian aircraft, total	1,102	92,504	1,166	100,422
Aircraft 3,000 lb and over empty airframe weight				
Cargo transport, commercial, new				
Passenger transports, commercial, new				
3,000–14,999 lb empty airframe weight	31	2,341	25	1,780
15,000–29,000 lb empty airframe weight	2	830	5	2,364
30,000 lb and over empty airframe weight	47	66,262	40	56,396
Rotary wing aircraft, commercial, new	5	872	13	1,802
Commercial and civilian aircraft, used and rebuilt, including converted	100	12,867	176	30,260
Aircraft under 3,000 lb empty airframe weight				
Utility, commercial and civilian, new				
3 places and under	199	1,248	211	1,364
4 places and over	422	5,332	322	3,823
Rotary wing commercial new	38	1,450	36	1,369
Commercial and civilian aircraft, used and rebuilt, including converted	257	1,300	337	1,259
Commercial and civilian aircraft, new n.e.c. (all empty airframe weights)	1	2	2	5
Aircraft engines reciprocating, new air cooled under 400 hp †	932	2,248	654	1,482
Aircraft, components, parts, and accessories n.e.c.‡		668,467		400,244

* Revised.
† Air cooled reciprocating engines new, 400 hp. and over are included in "Other aircraft, parts accessories"
‡ Includes military aircraft

SOURCE: Foreign Trade Division, Bureau of the Census

AVCO makes 18,000 mph stand still . . . with the Hypersonic Shock Tube. This AVCO development simulates, on stationary materials, the effects of 18,000 mph speeds to hasten perfection of an advanced Air Force missile system. This and many other challenging projects await you at AVCO.

PRIVATE LINES

Production run of 10 Paulistinha lightplanes, powered by 90-hp engine, is underway in Sao Paulo, Brazil with output of 60-70 aircraft planned annually.

Safeway Airways, Anchorage, Alaska, is new regional distributor for National Aeronautical Corp. (Narco) radio and navigation equipment.

Sylvania Electric Products, Inc., plans construction of a $180,000 hangar measuring 120 ft. x 80 ft. at Boston-Beverly Airport, Mass., for its executive DC-3. The electronics firm has seven of its 46 plants located near the field.

Traffic pattern at Boston-Bedford, Mass., airport has been altered to meet Air Force requirements. Planes which can maintain an indicated airspeed of 110 mph. or higher in the pattern will enter at 1,300 ft. above sea level or 1,200 ft. above the surface. Aircraft which cannot maintain this airspeed will enter at 900 ft. above sea level or 800 ft. above the surface. Requirement stands that all aircraft entering the control zone have two way radio.

U. S. Air Force contract covering aircraft mechanics instruction for personnel of 9047th Reserve Group was awarded East Coast Aero Tech, Boston-Bedford, Mass., airport.

Float Kit

Float repair kit for on the spot do-it-yourself work will take care of spots about one-half square foot in area until more permanent fix can be made. Each kit provides sufficient plastic and screen material for about five medium-size repairs on seaplane floats. Kit was developed by de Havilland Aircraft of Canada, Ltd., Toronto, Ont.

USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by Air Force Contracting Offices

SAN ANTONIO AIR MATERIEL AREA Kelly Air Force Base Tex.

General Motors Corp AC Spark Plug Div Flint 2 Mich., plug spark (facilities on rental basis) 4752 AC261 (PR 03H SA-841402 and SA-841402 1 (complete) 277168 ea $222521

General Motors Corp. AC Spark Plug Div Flint Mich., plug spark (facilities on a no-charge for use basis) 4753 AC265 (PR 53H SA 841403 and SA-841403-1 (complete) 261971 ea $304934.

Wilkes Engineering & Construction Co (of Iowa) 1441 Second Avenue Des Moines Iowa installation of fixed radio and radar facilities at TM-155 at Zapata, Tex (IFB 41 608 56 287) job $39142.

General Electric Supply Co., 1211 N Huckberry St San Antonio Tex electrical bus duct breakers and fittings (see attached) (IFB 41 608 56 287) $8 088

MIDDLETOWN AIR MATERIEL AREA Olmsted Air Force Base Middletown Pa.

Curtiss-Wright Corp., Wright Aeronautical Div Wood Ridge N J rework of blades rotor turbine for J65 series aircraft engines 230989 ea $327975 PR 01898.

Avien Inc. 58 15 Northern Blvd. Woodside 77 N Y indicator liquid quantity transmitter liquid quantity RFP PR 701497 & 701239 710 ea $88385

Telecomputing Corp., Whittaker Gyro Div. 16217 Lindbergh St. Van Nuys Calif parts for indicator turn and slip RFP PR 18831 35226 ea $76115

General Electric Co. West Lynn Mass transformer assy., armature, etc RFP PR 597845 33322 ea $44430

Allied Chemical & Dye Corp General Chemical Division 48 Rector St New York 5 N Y fuel rocket 47840 lb $287657. IFB PR 1834

Gustav Hirsch Organization Inc. 137 West Fifth Ave., Columbus 12 Ohio installation of telephone plant Loring Air Force Base Maine $53515 IFB F/R no (MANN) 56 262 A

Airpath Instrument Co., Lambert Field St. Louis Mo unit post washer jewel etc IFB PR MA 597591 187592 ea. $40187

National Light Metals & Plastic Co., 345 Columbia Cass Mich container aerial delivery IFB PR MA 59750a 1208 ea, $108478

Lam Building Corp 1001 Wood St Philadelphia 7 Pa construction of concrete and steel substructure and erection of tempair type towers IFB PR (MANN) 56 252-1 job $83372

OKLAHOMA CITY AIR MATERIEL AREA Tinker Air Force Base Okla

Hydro-Power Corporation 10 Pine Court New Rochelle N Y retainer valve and spring hydra-power (RFP 418 031 1-OC-498886) 38 items $27185

Wm R Whittaker Co., Ltd 915 North Citrus Ave Los Angeles 38 Calif seal shear solenoid valve teflon (RFP 39 031-2 OC 849373) 72 items $185867

PreFlite Equipment, Inc., 717 So Hindry Inglewood 1 Calif floodlight unit (IFB 34 601-58-377) 1 items $ 4265

Vickers Inc Administrative & Engr Center 1100 Oakman Blvd Detroit 32 Mich., valve assy hyd pressure (RFP 136-131-2-OC-641834) 97 items $172709

Industrial Design Laboratories Inc 12125 Wagner St Culver City Cal fan tube-axial fixed unit direct (RFP 421035-OC-648330) 48 items $106075

Stratos Div Fairchild Engine and Airplane Corp Orinoco Dr & Manor Lane Bay Shore Long Island N Y cartridge intermediate and housing (RFP 411-032-OC-418374-C1) 41 items $141113

Hydra Air Inc. 3000 Winona Avenue Burbank Calif valve-plug flow style 3 way 3 port (RFP 39 031-1 OC 669798) 18 items $151087

Wm R Whittaker Co Ltd, 915 N

F8U Formation

Chance Vought's F8U Crusader now in quantity production at Dallas, Tex., is nearing operational status. Fifteen Navy pilots, six of them from VF-32 based Cecil Field, Fla., the first squadron which will receive the F8U, have completed a familiarization course in the aircraft.

Citrus Avenue Los Angeles, Calif disc butterfly valve (RFP 302-03F OC 646385) 45 items. $129193

East Coast Aeronautics Inc., 10 Pelham Parkway Pelham Manor N Y rep all filler (RFP 486-03M MO 436007) 2 items, $43172

Airesearch Mfg Co Div of The Garrett Corp. 9851 9951 Sepulveda Blvd Los Angeles 45 Cal valve assy air shutoff modulating elec (RFP 460 031-OC 693308) 16 items $36542

Fairchild Engine & Airplane Corp Stratos Div., Bay Shore Long Island N Y overhaul and modification of cabin cooling unit (OC 70484 & C1) job $461100

Boeing Airplane Co, Wichita Kans modification and IRAN of 116 ea B-47 type aircraft (OC 73,550 OC 7310-0-1C1 -C2 -C3) job $2800000

AiResearch Mfg Co Div of Garrett Corp 9851-9951 Sepulveda Blvd Los Angeles 45 Cal regulator assy (RFP 331-03F-648815) 114 items $36474

Jacobs Aircraft Engine Co 150 Queen St, Pottstown Pa crankshaft assy (RFP 402-Ro2 467 2499ASO SC82) 3 items $62807

B F Goodrich Co 500 S Main St Akron 18 Ohio packing O ring (IFB 34-661 56 4o2) 1 item 027397

Bowser Metal Processing Company, Inc., Independence Kans technical order compliance (fuel booster pumps) (OC 7296041), job $70132

United Aircraft Products Inc, 1116 Bolander Ave Dayton 8 Ohio valve assy all thermostatic relief (RFP 4170021 / OC 099380) 4 items $30145

Midwest Aircraft Div of Culver Aeromarine Corp 2214 Hoover Ave Dayton 7 Ohio rap assy-filler coolant expansion tank (RFP 481 03F OC-046196) 1 item $31830

Libby Owens Ford Glass Co 808 Madison Avenue Toledo 1 Ohio window pilots cabin (RFP 346-01F OC 691577) 4 items $836.6

Johns-Manville Sales Corp 1701 E 7th St Tulsa Okla. blanket turbine installation (OC 65665 C1) job $111002

Solar Aircraft Co 2200 Pacific Highway San Diego Calif overhaul of gas turbine assemblies model T41M-8 (OC-098572) job, $29498

Adel Precision Products, Div of General Metals Corp 10777 Van Owen St Burbank Calif pump assy fuel booster (RFP 484 031 R56-9140 TCSMC1 2 items $30426

Mansfield Aircraft Products Co., Div of Richland Aviation Inc Municipal Airport, Mansfield Ohio oven type B 4 model 101 (IFB 34-001-56-128) 2 items $116524

SHELBY AIR FORCE DEPOT, Wilkins Air Force Station Shelby, Ohio

General Dynamics Corp Convair Div, Fort Worth Tex misc spare parts for SE2104-3 bar assy SE2110 acft truck, S/N 8200 062275 towing bar assy P/N SE 2151 main landing GR truck SF2169 and SE-216901 eland 8220-406300 hoisting apparatus 8220 170080 truck assy SF2155 adap eng trans SE2247 harness assy and SE2320 bin (PR WL 547623 thru WL-547627 WL-547629 thru EL-547533) 7533 ea $97416

Smith-Nelson Corp 36 E Mason St., Santa Barbara Cal spare parts for type F0 jack assy (PR WL 547543), 8510 ea, $70055

Joyvel Co. of New Mexico 205 Plaza Las Vegas, N Mex., webbing assembly parts, appl P/N 34J23124 runway barrier (IFB 33 602 56-1481 6663 ea $968310.

Cocda Chemical Corp 24 Smith St Norwalk, Conn cloth coated nylon 36 in wide, color white flame resistant class 2 type 11 spec MIL-C 4479 (USAF) dtd 29 Jul 52 (RFP 33 602-56 2071) 2162 yds $23545

ROME AIR FORCE DEPOT Griffiss Air Force Base N Y

Graybar Electric Co, Inc 327 N West St. Syracuse N Y insulator knox pare nr 334 20000 ea Insulator knox pore nr 502 25,100 ea (IFB 30-636 56-595B) $50986

Reeves Soundcraft Corp 10 East 52nd Street New York 22 N Y., reels of tape for the RD-142/UN (IFB 30-635-56-331B) 27659 ea $744618

The Foxboro Co 38 Neponset Ave Foxboro Mass recorder-relative humidity and temp. portable (IFB 30 635-56 401B) 200 ea $31292

Collins Radio Co 855 35th St, N E. Cedar Rapids, Iowa modification kits (RFP 30-635 56 4151Q) 6087 ea $1473033

Republic Electronic Ind Inc., 31 W 27th St. New York 1 N Y cabinet patching AF and DC list 8 ea, switchboard patching communication 6 ea, audio test and patching bay 1 ea (IFB 30-635 56 500B) $41100

Lavoie Labs, Inc, Matawan Freehold Rd, Morganville N J power supply (RFP 30-635-56 4 62Q) 16 ea $50700

H R Beebe Inc 110 Genesee St. Utica N Y modification of building no 240 (IFB 30 635 56-357B) job $40320

Federal Mfg and Engineering Corp 1055 Stewart Ave Garden City Long Island N Y maintenance spare parts to support 1087 ea radio set (AN/GRC-32B (RFP 30 636 065811Q) $229000

Graybar Electric Co, Inc 327 North West St Syracuse N Y anchor screw, (chance 1-2-A) 200 ea terminal wire WECO 10-R 480 ea reel appleton #RE-BF1 010 32 ea (IFB 30-635-56-267B) $36264

Dresser-Ideco Co 875 Michigan Ave Columbus 8 Ohio tower AB-259A/FPS 6 54 ea (IFB 30-635 56-177B) $2408313

Joy Mfg Co 1762 Macklind Ave St Louis 11 Mo cable assembly-power IAW AF Dwg 51D 22685 MIL C-5756B 200 ea, (IFB 30-63 56 272B) $20338

Amneo Mfg Co 3 River St., Morristown, N J cord assy H-46A/UR headset, 1400 ea, (IFB 30-635 56-203B) $61526

Collyer Insulated Wire Co 245 Roosevelt, Ave Pawtucket R I cable power electric c/w spec MIL-C-5130A, 8160010 (IFB 30-635-56-343B) $288416

WARNER ROBINS AIR MATERIEL AREA Robins Air Force Base Ga

Acme Steel Co 2510 Archer St Chicago Ill "Dexion" slotted angle steel (PR 23A-10817 local purchase) 258000 ft, $47714

U S Valve & Mfg Co 250 E. Grand Ave. South San Francisco Calif. tube bender geared hand powered (IFB 499) 48 ea $44443

Peck Stow & Wilcox Co., Southington Conn shearing machine metal squaring foot powered 16 ga X 36 in cap (IFB 478), 12 ea $34080

Aerial Machine & Tool Corp 20-27 39th St. Long Island City 1 N Y. bank and link assy applicable to MA 4 bomb rack (IFB 387) 2341 ea 049031

R H Smallings Sons 801 Forsyth St., Macon Ga construction of armament test-

ing bldg at Robins Air Force Base, Ga. (IFB 2-1 job $34492.

AC Spark Plug Div., GMC Milwaukee. Wire modification kits for A-1A bombing navigational computer (PR-13047 and 6N1047) $58542.

Sheridan Pioneer Co. Macon Ga. additional modification to bulk supply warehouse $37500.

Heyer Products Co. 171 Constlandt St., Belleville N. J. rectifier metallic type 1-8 DI power supply portable SV-200 amp output IAW specs MIL-R-7406 and MIL-P-8457A (PR-8 94262) 291 ea. $141840.

TOPEKA AIR FORCE STATION Topeka Kans.

Aluminum Co. of America, 1209 Ring Bldg, Washington D. C. aluminum sheet (IFB 14-601 56-842) 74092 lb $33810.

Columbia Southern Chemical Corp. One Gateway Center Pittsburgh Pa. trichloroethylene (IFB 14-604 56-905) 162o800 lb, $17857.

Carbide & Carbon Chemicals Co., Div. of Union Carbide & Carbon Corp., 30 E. 42nd St. New York N. Y. ethyl alcohol (IFB 14-604 56-286) 68168 gal $35408.

Army Contracts

Following is a list of unclassified contracts for $25,000 and over, as released by Army Contracting Offices.

THE ARMY AVIATION CENTER, Fort Rucker, Ala.

Hayes Aircraft Corp. Birmingham, Ala. maintenance of approximately 240 fixed wing and 260 rotary wing Army aircraft work to be performed at contract site with government furnished materials and major tools consisting of all phases of maintenance on assigned aircraft to include limited depot rebuild. job $1948581.

THE ARMY SIGNAL SUPPLY AGENCY, 225 S. Eighteenth St. Philadelphia 3, Pa.

Sperry Rand Corp., Great Neck, N. Y., helicopter flight directors, contract no. 61872 (PR sig M-384-56), 2 ea, $37335.

Sikorsky Acft Corp., Stratford, Conn. automatic stabilization unit for H-34 helicopter contract no. 07890 (Pr ing M-523-55) 1 ea. $28873.

Technical Research Group, New York N. Y. research & development of nuclear resonance filters for radar communication application contract no. 7-408 (PR&C 56-ELR/H-7121 job $46010.

Airborne Instr Labs Inc., Mineola N. Y. monitor radar performance contract no. 78332 (PR&C 56-ELH/P-22387) 3 ea. $31700.

Hiton Mfg. Co., Pasadena, Calif. modification of Army aircraft and installation of surveillance equipment modification contract no. 67470 (PR&C sig M-11-56 1 lot $124072.

CORPS OF ENGINEERS, U. S. Army Office of the District Engineer Albuquerque District P. O. Box 1538 Albuquerque N. M.

Pittsburgh-Des Moines Steel Company 1215 Praetorian Bldg Dallas 1 Tex. (unrestricted) construction of water reservoir missile test area, Holloman Air Force Base, Alamogordo, N. Mex. (Contract No. DA-29-005-ENG 1730 IFB Eng 29-005-56-83). job $238300.

Navy Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Navy Contracting Offices.

AVIATION SUPPLY OFFICE 700 Robbins Ave. Philadelphia 11, Pa.

Eddington Metal Specialty Co., 3088 Bristol Pike, Eddington, Pa., J34 fuel nozzles (383/2117-2727/51/AERO) 1600 sets, $201000.

Joyce Electric Co., 149 Hillside Ave. Williston Park Long Island N. Y. microphone assys (383/2139 1146/-2/AERO) 11700 ea. $63435.

Taylor Lawrenstein & Co., 56 N. Commerce

St. Mobile Ala. roain guns (IFB 383 1660-56) 360000 lbs $34356.

Pioneer Central Div. Bendix Aviation Corp Davenport Iowa indicators, (383/210-6J9X4/4/51/AERO) 131 ea $53782

The Kaman Aircraft Corp Old Windsor Rd. Bloomfield Conn handbooks of overhaul instructions covering transmission assys. (PDEN 11-5430/56(780-53) various $26385

Utica Div., Bendix Aviation Corp., Utica N Y mounting head assys. (383/2116-175/53/AERO) 244 ea $28150

Bendix Aviation Corp Bendix Product Div 401 Bendix Drive South Bend 20 Ind maintenance parts used on strut assemblies (383/2110 1027/53/AERO) various $41535

Jack and Heintz Inc., 17600 Broadway, Cleveland 1 Ohio parts for Jack & Heintz starters (383/2118-176/53, 383/2116-41/53) various $178805

Kollsman Instrument Corp 80-08 45th Ave Elmhurst N.Y., period-altitude switches (383/2116-2122/52) 263 ea, $27337

DISTRICT PUBLIC WORKS OFFICE TWELFTH NAVAL DIST, SAN BRUNO CALIF

Vance M Brown & Sons, Inc P O Box 506 Palo Alto Calif parachute buildings at the Naval Air Station Moffett Field Calif (IFB NOy-516511 job $107600

SUPPLY DEPARTMENT, Naval Air Material Center Naval Base Philadelphia 12

Mckiernan-Terry Corp 606 Manor Ave Harrison N J following parts in accordance with Mil Dwg and Specs spear assembly water brake, NAF part no 14-68479-1, 60 ea piston & stud assembly NAF part no 12-13746-1 70 ea IFB nrg 156/75064/56Q (N156-63362) $134570

Franklin Institute of the State of Pennsylvania 20th St. & Parkway Philadelphia 3 Pa engineering services required in connection with preparation of aircraft performance calculations IFB nrg 156-261374-56Q (N156-33273) max. amount $30000

Mckiernan-Terry Corp., 606 Manor Ave. Harrison N J choke rings bronze water brake cylinder in accordance with Mil dwgs and specs IFB nrg 156-780042 56Q (N156-33667) NAF part No 14 40066-1 110 ea, $31480

Gardiner Mfg Co., 2767-11 Union St Oakland 8 Cal following parts in accordance with Mil dwgs and specs hooks, steel bridle arrester, NAF part no 310009-1 3275 ea bullets steel bridle arrester NAF part no 310014-1, 2100 ea shackle assembly NAF part no 316020-1 3850 ea IFB nrg 156-261438-56Q (N156-33339) $39784

NAVY PURCHASING OFFICE 4th & Independence Ave SW Washington D C

Jack & Heintz Inc 17600 Broadway Cleveland Ohio AN4110R3B electronic direct cranking starters (N600(A)32103) (IFB 600-1423-56) spec MIL-S-5150A 744 ea $181054

Pioneer Central Div. Bendix Aviation Corp Davenport Iowa oxygen regulator P/N 2867 B1 (N606(A)40870) (Neg. 944 56Q) 11822 ea $2556183

California Eastern Aviation Inc International Airport Oakland Cal transportation of Navy cargo by air (N600(SA)42116) Neg 1891 56Q) 1892840 miles $2476558

Be Ge Mfg Co., Leavesley Rd. Gilroy Calif rocket launcher package Aero 7D (N600(A)42125) (IFB 600-1142-56) 44963 ea, $4000654

U S NAVY PURCHASING OFFICE Los Angeles 15 Calif

Ampex Corp. 934 Charter St Redwood City Calif., video tape recorder Ampex Electric Corp Mark 111 N123(61756)9975A (RFP 123-62275(5-10-56) ea $75022

Electro-Mechanical Research Inc Ridgefield Conn telemetering equipment model 66A 2 rack control panel & ventilator discriminator model 67 D etc. N123(42738)8875A (Sch61862-5-25-56) ea 47 $27779

Maytag Aircraft Corp P O Box 1142 Colorado Springs, Colo services incident to aircraft refueling/defueling at the U S Naval Air Sta North Island San Diego Calif N123(246)8021A, (IFB-123-064 56) gals 26273, $407472

WHO'S WHERE

(Continued from page 23)

Changes

Donald M. Hazard, chief engineering operations Florida branch, Pratt & Whitney Aircraft, East Hartford, Conn.

Arthur N. Corner, project manager missile test equipment, and **Capt. Upton S. Brady, Jr.** (USN ret.) project manager missile guidance equipment, Farnsworth Electronics Co., Fort Wayne, Ind.

William Q. Nicholson, chief staff engineer, Ryeon Manufacturing Co., Pasadena, Calif.

Dr. R. Wayne Parcel, chief metallurgist, Dalmo Victor Co., Belmont, Calif.

Roger A. Burt, manager Systems Analysis Section, Electronic Control Systems, Inc., Los Angeles, Calif.

Col. Howard M. McCoy (USAF ret.) Washington representative, Propeller Division, Curtiss-Wright Corp., Caldwell, N. J.

Dr. Donald P. LeGalley, scientific staff consultant, AC Spark Plug Division, General Motors Corp., Milwaukee, Wisc.

H. Stever Tremper, customer relations manager, Vertol Aircraft Corp., Morton, Pa.

John B. Downs, sales engineer, Jay Engineering Co., Dayton, Ohio.

Rod Kontnik, designer, has joined the Automatic Controls Division, Clary Corp., San Gabriel, Calif. Mr. Kontnik formerly was with the Jet Propulsion Laboratory at the California Institute of Technology.

Baboo Ram Teree, chief engineer, Greer Hydraulics Inc., Jamaica, N. Y.

Edward A. Carroll, manager aircraft performance, and **Walter D. Sherwood,** manager power plant research (Kansas City), Trans World Airlines.

L. S. Preston, chief engineer, and **D. R. Proctor,** assistant chief engineer, Electronic Engineering Company of California, Los Angeles, Calif.

Chet Lubben, director-sales administration, Frontier Airlines, Inc. **Gordon W. Dahl** succeeds Mr. Lubben as Denver district sales manager.

Al Nadeau, chief sales engineer, Gladden Aircraft Products Corp., Glendale, Calif.

Karl W. Galliger, director-engineering, and **John A. Vaughan,** manager-engineering, Watertown Division, New York Air Brake Co., Watertown, N. Y.

Dr. Raymond H. DuHamel, head, Research and Development Antenna Group, Collins Radio Co., Cedar Rapids, Iowa. Dr. DuHamel is research assistant professor and supervisor of the Antenna Laboratory of the University of Illinois.

J. Frank Leach, director manufacturing, Amphenol Electronics Corp., Chicago, Ill.

Byron Nierenberg, chief application engineer, Car Precision Parts, Inc., Stamford, Conn.

Roi S. Fisher, vice president-director of sales, National Vulcanized Fibre Co., Wilmington, Del.

Dr. John L. McLucas, vice president and technical director, Lopp Industries, Inc., Los Angeles, Calif. Dr. McLucas' headquarters will be at State College, Pa.

Jack F. May, vice president sales, TAC Airlines.

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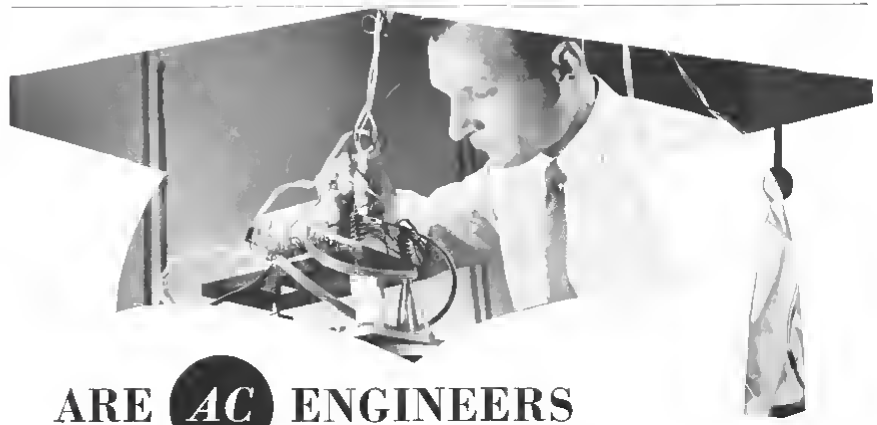

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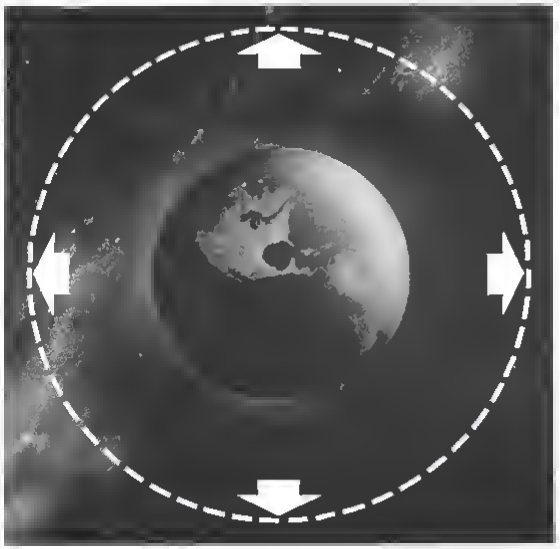

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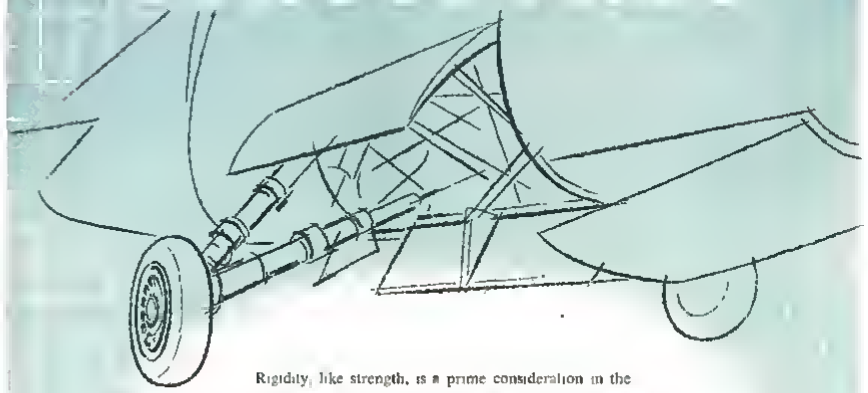

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Engineering Personnel Dept. 12-3A

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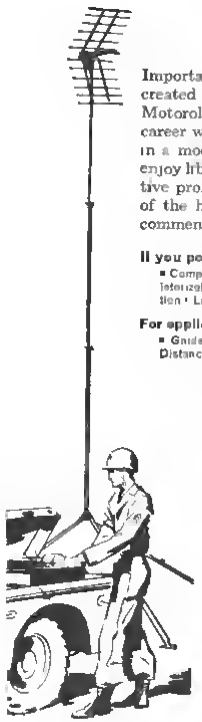

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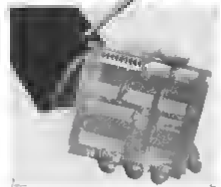

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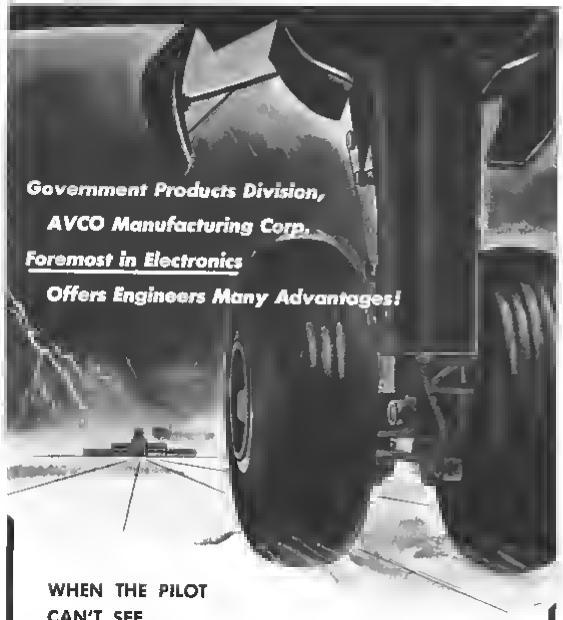

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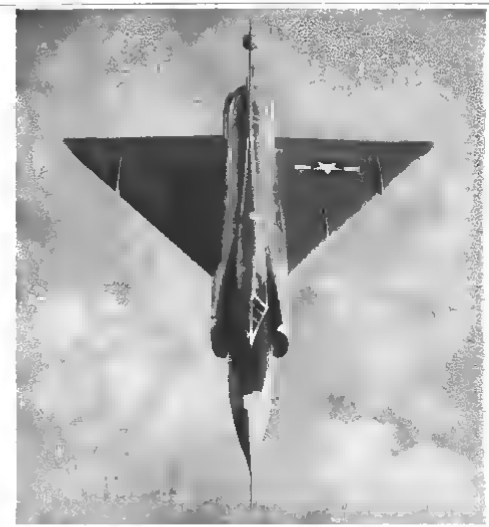

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LETTERS

NACA Editorial

I hope that next time in the days ahead when you may have occasion to take another hard look at the work the NACA is doing your assessment of the effectiveness of our organization will be as favorable as that expressed in your editorial of Nov 5th. I believe I can speak for the entire organization when I say we shall do our utmost to continue to deserve such warm and favorable sentiments as you expressed.

A pat on the back sometimes helps, I know that at the present time your comments will prove an inspiration to our people. Many thanks.

J. W. CROWLEY
Associate Director for Research
National Advisory Committee
for Aeronautics
Washington, D. C.

Please accept my warmest congratulations on your splendid editorial of Nov. 5 concerning the NACA. As the attached copy and covering memorandum indicates, we had it reprinted for our staff and the comments have been uniformly good. Morale is a notorious intangible, but I know that our people felt most heartened to see their work recognized so generously in an important industry publication. I feel sure that its importance in relation to our serious problems of recruiting and retaining outstanding engineers and scientists will be felt for a long time to come. To my personal thanks I want to add those of our entire staff.

SMITH J. DEFRANCE, Director
Ames Aeronautical Laboratory
Moffett Field, Calif.

I am enclosing a copy of our laboratory paper, Wing Tips, in which we reproduced AVIATION WEEK's editorial "Spearhead of Progress." Many thanks for allowing us to do this.

We are naturally very pleased that you and AVIATION WEEK feel the way you do about the NACA and its work. Your public expression of this thought has been a morale booster to many persons in the organization who are making a personal financial sacrifice to carry on work which is so important to our country.

EDWARD R. SHARP, Director
Lewis Flight Propulsion Laboratory
National Advisory Committee for
Aeronautics
Cleveland 11, Ohio

In your editorial on the NACA in a recent issue of AVIATION WEEK (Nov. 5), you were kind enough to list me among those whose work has been of value to the aviation industry.

AVIATION WEEK has printed many complimentary remarks about our work in the flight safety field. Because of the prestige your magazine enjoys, these comments have had an enormous effect on the morale of those who engage in this difficult, and very often thankless, work.

For your many kindnesses to me and my associates, I am indeed grateful. Many thanks to you for being so considerate.

ERLING PINKEL
Chief, Flight Problems Division
Lewis Flight Propulsion Laboratory
Cleveland, Ohio

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters but names of writers will be withheld on request.

ALPA "Demands"

Your issue of Nov. 19 (p. 39) has a report on what bargaining "demands" the ALPA will make on the airline industry for the coming jet age. I can recall that it was not too long ago that ALPA "demanded" of two of the largest airlines in the U. S. that their pilots be trained as A&E mechanics. The companies wisely told them "No," or ignored the "demand." Comes now the very same so-called "labor organization" for pilots pontificating on the crew requirements for the new jet airplanes.

Then (ALPA) say now that a pilot would be as qualified as a mechanic in the F/E station on the jets and would give (whom?) an added advantage of providing a full safe protection in the event of an emergency. The ALPA also "doubted" the value of a mechanic crew member on turbine aircraft. One must wonder if the members of this "captain's union" are more interested in the duties of the other crew members and performing same to the extent of further ignoring their own duties and areas of responsibilities. If this be so, we can all agree that safety in air transportation is seriously compromised.

I believe that ALPA is struggling with the all too plain truth—the specter of large scale pilot lay-offs once the jet fleets are integrated into airline service. Any school boy can easily see how these jets are capable of doing the same work as a dozen or more present day piston engined airliners.

The DC 7 flying non-stop coast to coast takes an average (or slightly over) of eight hours. There is one captain, one copilot, one autopilot, and one flight engineer.

Enter now the new jets; they will fly the same distance in four and one half or five hours. The crew will consist of one captain, one copilot, one autopilot, and one flight engineer. We must then presume that ALPA pilots are not able to fly these newer and faster airplanes without the addition of an extra pilot as a "fail safe" item. Or they are qualifying themselves for the present to the extent that two pilots are not enough to handle any flying emergency, plus monitoring the engines and systems on contemporary airplanes in addition to keeping up with the multitude of pilot duties found in the flight decks of today.

These newer, faster airplanes will require much closer attention to flying technique and duties, plus a more concentrated attention to airways and navigational plans coupled with the need for still looking out the windows for traffic. With all these duties for a captain and a copilot, we fail to comprehend any logic that would require a third pilot in the cockpit performing the duties of a flight engineer.

One, therefore, must conclude that these ALPA "demands" are aimed more at capturing the flight engineer station for the captain who can no longer pass a first class physical than at contributing something worthwhile to promote air safety. This contention "smokescreen" does not hide the basic fact that ALPA is concerned over the strong bargaining and gains made by the Flight Engineers International Assn. and the threat to future cockpit wage relationships that this flight engineer group poses to them.

Many air carriers are still continuing to hire skilled A&E qualified flight engineers for their present fleets as well as for the turbine driven airplanes. Only these men possess the necessary background of mechanical experience which these companies are relying on to save dollars and cents all the while giving the flying public a higher degree of proven air safety. The airlines using a mechanical background man for the flight engineer's job, as well as the flying public, are not blind to the obvious benefits of such a wise program. That alone is enough to offset any more "demands" by the ALPA.

DAVID J. LANDRY
Flight Engineer
Chicago, Ill.

Flight Engineer Role

Congratulations are in order to Career Flight Engineer (AW Sept. 10 Letters p. 166). Also to W. T. Northacker, flight engineer (AW Oct. 8 Letters p. 170).

Their letters express my feelings on this subject 100%.

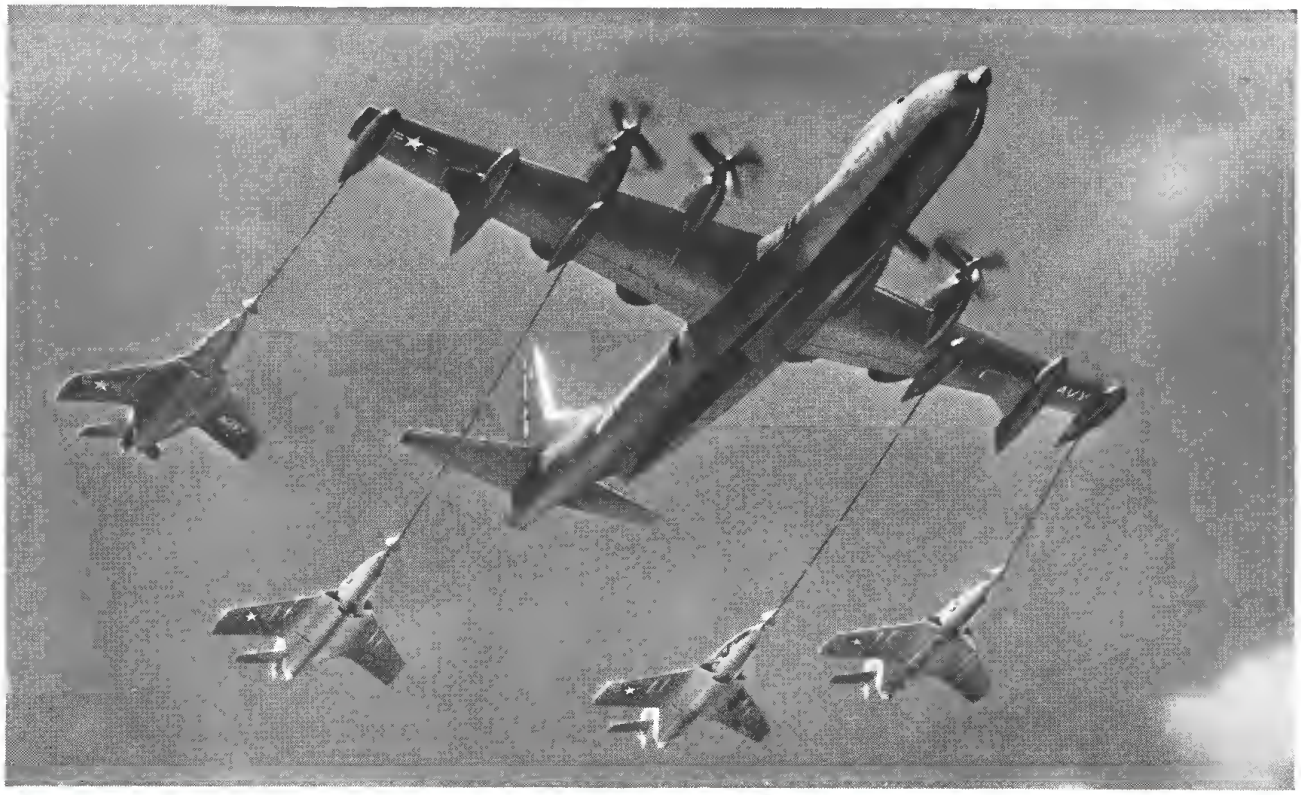
Most of the flight engineers on the airlines today are ex-maintenance men, as it should be, concerned with the safety of flight.

Certainly no pilot with only a few weeks training in basic fundamentals of flight engineering can by any stretch of the imagination, call himself a "flight engineer."

A pilot does not share the same interest in the airplane as a flight engineer. He knows little about its systems and components, trouble shooting, etc., and cares less. They seem to think that once a F/E rating is obtained they can coast along till the day comes when they can be a pilot again, thanks to a lax CAR. We can all be thankful these people are in the minority.

Most flight engineers are not the least bit interested in becoming pilots. The modern transport of today takes two professional men to operate it safely and efficiently. I have seen too much of this business of trying to cross the two occupations. It does not work.

J. A. BOCK
Flight Engineer
Pacific Northern Airlines, Inc.
Seattle, Wash.



NAVY FLIGHT SETS NEW RECORD

Allison Turbo-Prop-powered "Tradewind" opens new era in vital Pacific Fleet service

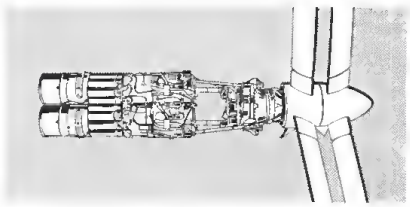
A few weeks ago the U.S. Navy opened a new chapter in aviation history when its giant aerial tanker – the Convair R3Y-1 Tradewind – set a new trans-pacific speed record for water-based aircraft. On its maiden round-trip flight from Alameda, California, to Keehi Lagoon, Honolulu, Air Transport Squadron TWO [VR-2] firmly established the Navy's long-standing belief in turbo-prop power as the jet age's most flexible and efficient power source. On its return flight the Tradewind covered the nearly 2,500 miles over water span in 6¾ hours, far surpassing the record on this route for this type aircraft.

Powered by four Allison twin power section turbo-prop engines driving contrarotating Aeroproducts Propellers, the Tradewind boasts nearly 24,000 horsepower—can lift its 80-ton weight from the water in 30 seconds, climb quickly to cruising altitude and cover more than 2,000 miles nonstop at speeds in excess of 350 miles per hour.

What makes this astounding aerial feat possible is the development of a whole new concept of powered flight—the culmination of 10 years of research by the Navy, Convair and Allison. It required the solving of one of the most complex engineering challenges in aviation history—perfecting a gas turbine engine of advanced design and mating it with a six-bladed contrarotating propeller.

The R3Y-1 Tradewind will refuel in flight eight jet fighters—*four at a time* —at speeds of more than 350 miles per hour. This new addition to the vast Pacific Fleet, the R3Y-1 will provide a vital service to our fast carrier task forces, further extending the range and striking power of the Navy's mighty air arm.

ALLISON DIVISION OF GENERAL MOTORS CORPORATION
Indianapolis, Indiana



R3Y-1 demonstrates versatility of Turbo-Prop power in jet-age transportation

Record-breaking Navy R3Y-1 is powered by four T40 Allison Turbo-Prop engines like this—each having twin power sections driving contrarotating Aeroproducts Propellers. Both power sections in each engine give the R3Y-1 full power for rapid take-off and climb to cruising altitude. To gain best fuel economy for cruising, one power unit may be shut off entirely, allowing the other to operate at its most efficient setting. Either power section operates all six blades contrarotatively.

ALLISON
TURBO-PROP POWER
VERSATILE POWER FOR JET-AGE FLIGHT